JPRS 83240

12 April 1983

# China Report

## SCIENCE AND TECHNOLOGY

No. 194

## CHINA EXAMINES SCIENCE POLICY -- II

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# 'BEIJING REVIEW' ON SCIENCE, TECHNOLOGY

HK231414 Beijing BEIJING REVIEW in English No 7, 14 Feb 83 pp 14-18

[Article by Hu Ji, staff member of the Economic Research Center under the State Council: "Chinese-type Modernization (5): Updating Science and Technology"--passages within slantlines published in boldface]

[Text] Our objective of modernizing science and technology is gradually to shift all sectors of the national economy to an advanced technological basis. It undoubtedly will be difficult to achieve this in a country like ours, where the economy and technology are undeveloped, and for a long time insufficient attention was paid to science and technology or to intellectuals. This article will discuss how the goal will be achieved.

China's scientific and technological undertakings have grown space since the founding of the People's Republic of China. The country now has 5.7 million scientific and technical personnel, of whom 330,000 are scientific researchers.

The Chinese Academy of Sciences, the country's research center of natural sciences, has more than 110 research institutes, and the various ministries, provinces and regions operate another 4,300 research institutes. These, plus the various key enterprises' research agencies for applied science and technology, have created an independent scientific and technological research system with fairly complete branches of learning.

Our successes reflect the high level China has reached in some important scientific and technological areas, such as in testing atom and hydrogen bombs and guided missiles, in launching and recovering satellites, in launching carrier rockets from land and underwater to predetermined sea areas, and in the syntheses of bovine insulin and yeast alanine T-RNA. In general, however, our science and technology are still very limited.

The key to modernizing China's science and technology is not determined by whether the Chinese people have intelligence and wisdom--they do--but by whether government policies will bring the people's intelligence and wisdom into play.

Fortunately, we have introduced many effective policies in recent years after the influence of "left" mistakes was eliminated.

In the light of China's actual conditions aswell as the trends of scientific and technological development abroad, we have formulated new principles for scientific and technical development.

These principles stress that economic and social development relies on the progress of science and technology, scientific and technical work must serve economic construction and that we must create a new respect for science, technology and intellectuals throughout the whole society.

The specific policies and measures include:

//1. Drawing up a long-term plan for a balanced development of the economy and society on one hand, and of science and technology on the other.// This plan will overcome the separation between the two and will provide scientific grounds for the goals of China's economic development, the reform of economic structure, the deployment of productive forces, the changes of the consumption structure, the rational utilization of resources, the technical transformation of enterprises, the selection of technological policies and the arrangements of employment.

Economic and social development will present various topics to scientific and technical work and, at the same time, render great support to research. The principal task of scientific and technical workers should be to study and solve the key problems in national economic development. In the course of formulating and carrying out the plan, the economic and social development will be closely integrated with the progress of science and technology.

//2. Organizing forces to tackle key problems in scientific and technical research.// One weakness is our shortage of scientific and technical personnel and equipment for scientific research. The socialist planned economy, however, makes it possible for us to organize forces from all relevant fields to work in effective cooperation.

In the 1950s and 1960s, we broke the boundaries of different trades, regions and branches of learning to work jointly in successfully tackling some problems in advanced technology and in the manufacture of key equipment. This experience is a model for further development.

We will emphasize such areas as agriculture, consumer goods production, energy resources, transport and communications, new materials, large-scale integrated circuits and computer technology. In these areas projects that achieve good economic results and have an impact on scientific and technical development will be tackled as key problems.

We will adopt technical measures to increase output, centering on the breeding and cultivation of improved strains, in agriculture, forestry and animal husbandry. Comprehensive development will be undertaken in some big agricultural areas.

In the production of consumer goods, we will introduce new technology and equipment in spinning and weaving, printing, dyeing and finishing.

In developing energy resources, we will emphasize technical transformation centering on energy conservation, the comprehensive utilization of coal, geophysical oil prospecting, high-speed oil drilling and the exploration of new energy resources. We will strengthen research into improved methods of processing oil and chemical raw materials and into different kinds of new materials.

We also will conduct studies into atomic energy, computers, laser technology, remote sensing and superconductive technology as well as the research in the basic sciences.

Furthermore, we will conduct feasibility studies for key construction projects and will invite appraisals and consultations fromexperts in all relevant fields to allow us to choose the best among different plans.

//3. Emphasizing applied techniques and development studies.// The study of applied techniques and development is comparatively weaker than that of basic sciences. One reason is that some scientific research institutes and personnel emphasize theoretical study while neglecting to work on the large amount of practical scientific and technical problems that arise in production. This has resulted in chronic poor economic results in quite a number of enterprises.

In view of this, at the present stage, we should emphasize the study of applied techniques and development and of the basic sciences that are closely linked to production. We should also concentrate our limited personnel, material and financial resources in these fields so as to raise the country's technical level in production and stimulate the national economy.

//4. Selecting rational technological structure.// China has a large population and limited funds, and its productive forces are very unevenly developed. Thus, we must introduce, on a wide scale, advanced techniques that can save funds, energy and raw materials and need a large number of labour force but yield high economic results.

We can only introduce a small number of new techniques that call for concentrated funds and energy resources. Instead, we can develop on a wide scale new techniques that call for more labour or advanced knowledge.

In agriculture we will mechanize some aspects of production, and will adopt technical guidelines that stress biochemical measures, intensive cultivation and increasing per-unit output. In recent years, China has had excellent yields of crops of improved strains. The successful mass planting of improved strains such as the long-grained hybrid rice, the Lumian No 1 cotton and the maize inbreeder No 303, for instance, increased the peasants' annual income by 800 million yuan, 500 million yuan and 500 million yuan, repsectively.

In the different industrial departments, the degree of modernization of technical equipment varies greatly. In the heavy industrial enterprises, the fixed assets per worker average 11,000 yuan; in the light industrial enterprises, 4,500 yuan; the the handicraft enterprises, 12,50 yuan; and in the rural commune, and brigade-run enterprises, 1,000 yuan.

This imbalance cannot possibly be changed in a short period of time. Therefore, China's industry will remain technologically diversified, including the application of advanced automatic and electronic techniques, the utilization of mechanized or semi-automatic technical equipment and semi-mechanized and traditional manual operations. During the process of modernization, we must act within our own capabilities and progress gradually.

//5. Publicizing the results of scientific and technical results.// Many large enterprises in China have set up their own scientific research institutes in recent years, and some medium-sized and small enterprises have begun to work jointly to strengthen their scientific research work. All have achieved remarkable results in tackling technical problems in production.

In Changzhou, a medium-sized city in Jiangsu Province, more than 90 enterprises have established their own research institutes or groups. They also have coordinated efforts with more than 130 institutes of higher learning and scientific research institutes in other places. Over the last five years, the city's total industrial output value increased at an average rate of 13 percent a year. In rapidly developing cities such as Jiangsu Province's Wuxi, Hubei Province's Xiangfan and Liaoning Province's Siping and Dandong, half of the increased industrial output value of the last three years can be attributed to technological improvements.

Our government also has adopted a series of policies and measures to encourage technological upgrading of existing enterprises and mines. They include: incorporating into the state plan the demands to popularize new techniques, eliminate obsolete products and prohibit the use of inefficient techniques; allocating more funds to technological exploration; establishing enterprise funds for the trial production of new products; encouraging compensatory transfer of scientific and technical results; and introducing a pricing policy that fixes high prices for quality products and imposes penalties on poor-quality and outdated products.

//6. Attaching importance to importing, digesting and absorbing techniques.// Since China adopted the policy of opening to the outside world in 1978, the emphasis of our technical import has shifted from importing large complete sets of equipment to importing single techniques. Similarly, we have shifted from a stress on serving newly built enterprises to the technical transformation of existing enterprises.

Within the total volume of imported techniques and equipment in the state plan, the import of single techniques rose from 1.2 percent in 1979 to 28.6 percent in 1981. Within the total funds for technical import, the percentage of imported techniques and key equipment used for the technical transformation of existing enterprises rose from 0.6 in 1979 to 36.7 in 1981.

These imported techniques include designing, technological processes, manufacturing and management, some sample machinery, testing meters and instruments, key equipment and production lines. They are small in scale, cost comparatively little and yield quick results.

We must also organize scientific and technical personnel to study, digest and absorb the imported techniques so as to enhance our ability to develop science and technology through our own efforts.

In recent years, by absorbing and improving imported techniques and equipment, our machine-building industry has produced a series of new products which have improved the functions and quality of the complete sets of equipment needed by metallurgical, power, shipbuilding, textile and light industries.

The technical transformation we are now conducting in key enterprises will spread to all other enterprises. By the end of this century, we must strive to popularize throughout our country the techniques widely used by the developed countries in the late 1970s and early 1980s.

//Scientific and technological personnel in state organs and enterprises//

Year: 1981 Unit: 1,000

| Personnel: Departments | Total | Engineering and Technical | Agro-technical | Health | Scientific research | Teaching |
|---|---|---|---|---|---|---|
| Nation's total | 5,741 | 2,077 | 328 | 1,680 | 338 | 1,291 |
| 1. Industry & Construction | 1,596 | 1,229 | 4 | 268 | 15 | 80 |
| 2. Prospecting & Designing | 237 | 221 | 1 | 10 | 3 | 2 |
| 3. Agriculture, forestry, water resources & meteorology | 462 | 168 | 231 | 41 | 5 | 17 |
| 4. Transport, Post & Telecommunications | 174 | 152 |  | 19 |  | 3 |
| 5. Commerce, Foods, Services, & Materials Supply & Marketing | 47 | 25 | 10 | 11 | 1 |  |
| 6. Urban Public Utilities | 25 | 19 | 1 | 4 | 1 |  |
| 7. Scientific Research | 346 | 35 | 3 | 13 | 293 | 2 |
| 8. Culture, Education, health & Social Welfare | 2,534 | 45 | 2 | 1,286 | 16 | 1,185 |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| 9. Banking & Insurance | 3 | 3 |  |  |  |  |
| 10. Government Departments & Organizations | 290 | 180 | 76 | 28 | 4 | 2 |

//Composition of Sciencitic and Technological Personnel in State Organs and Enterprises//

Year: 1981 Unit: 1,000

| Personnel: <br> Categories | Total | Engineering and technical | Agro-technical | Health | Scientific research | Teaching |
|---|---|---|---|---|---|---|
| Nation's Total of which | 5,714 | 2,077 | 328 | 1,680 | 338 | 1,291 |
| 1. Female | 1,815 | 346 | 46 | 965 | 94 | 364 |
| Percent | 31.8 | 16.7 | 14.0 | 57.4 | 27.8 | 28.2 |
| 2. National Minorities | 218 | 54 | 26 | 80 | 9 | 49 |
| Percent | 3.8 | 2.6 | 7.9 | 4.8 | 2.7 | 3.8 |
| 3. Attended Colleges or Universities | 2,495 | 1,037 | 115 | 432 | 251 | 660 |
| Percent | 43.7 | 49.9 | 35.1 | 25.7 | 74.3 | 51.1 |

CSO: 4010/46

# 'SECOND GOLDEN AGE' IN CHINA'S SCIENCE AND TECHNOLOGY SEEN

Beijing RENMIN RIBAO in Chinese 20 Jan 83 p 3

[Article: "China's Science and Technology Enter a 'Second Golden Age'"]

[Text] The third National Academic Conference on the Theory of Science and Scientific Policy held recently in Nanning, Guangxi, concluded that our country's science and technology have entered a second "golden age."

The conference participants concluded that between 1956 and 1964 there was a golden age on China's scientific and technical front, and that since the smashing of the Jiang Qing counterrevolutionary clique, and particularly since the third plenum of the 11th Central Committee, scientific and technical work in this country has taken on a new look and made rapid progress, which indicates that it is in a second golden age.

The conference participants singled out the following tasks and main areas of effort for workers in the theory of science and science policy in the second golden age.

The conference participants signaled out the following tasks and main areas of effort for workers in the theory of science and science policy in the second golden age.

First, they must take part in drafting regional scientific and technical development plans, make suggestions on research reports, and furnish scientific data for establishing economic regions centered on large and medium-size cities. Second, they must take part in providing the substantiation for technical and economic policy in the various branches of industry and in research and experimentation with enterprise technical modernization and develop scientific research and its products. Third, they must study reforms of the scientific research system. Scientific research units, and particularly those engaged in applied research and technical development research, should implement the scientific responsibility system. The key is to establish a set of quantitative, scientifically-based review indicators for scientific research and conscientiously implement the principle of compensation according to work. Reform of the scientific research system should involve strengthening enterprise science and technical work. Fourth, they must study the management and utilization of scientific and technical personnel. The urgent problem is to break through geographical and departmental barriers, strengthen the guided movement of scientific and technical personnel, and make thorough use of the available personnel. The method of advertising for applicants must be used. Fifth, instruction and training in the theory of science must be given to students in advanced schools and to scientific and technical management cadres. Currently more than 40 advanced schools and many training groups for scientiology and technology management cadres are holding courses in the theory of science. This work must be further strengthened.

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CSO: 4008/50

## IMPORTANCE OF PRELIMINARY SCIENTIFIC-TECHNICAL WORK FOR CAPITAL CONSTRUCTION NOTED

Beijing RENMIN RIBAO in Chinese 12 Aug 82 p 3

[Article by Yang Jun [2799 3182], Vice Chairman, State Scientific and Technical Commission: "Attach Importance to Solving Key Scientific and Technical Problems in Preparatory Work for Capital Construction"]

[Text] For many years, failure to attach sufficient importance to solving key scientific and technical problems in the preparation for capital construction has produced serious losses and waste. The construction of the No 3 smelter of the Yunnan Tin Company is an example.

Since it began production, this company has accumulated more than 100 million tons of hard-to-classify tailings, including 200,000 tons which contain tin. Because they are low-grade material, the tin content is only about 0.16 percent, and the question of whether they could be recycled as a secondary tin resource has been under consideration for some time.

In 1970, on the basis of half a month's testing, more than 30 million yuan was invested in the hasty construction of a high-temperature chlorination facility with a capacity of 500 tons a day for processing hard-to-classify medium-grade ore (tin content 1.2-1.5 percent) at the company. After construction was completed, large numbers of technical problems arose with the experimental shop. Between April 1970 and November 1971 there were 12 tests of the experimental shop, but because of failure to make a breakthrough in key technical aspects the company was compelled to shut it down. This equipment is still sitting idle and producing no effect. At a monthly bank interest rate of 0.6 percent for floating capital loans, if the 30 million yuan invested were in the bank, the interest alone after 12 years would have been 39.09 million yuan, exceeding the amount of the original investment.

In order to recover this investment as rapidly as possible, in 1979 the State Scientific and Technical Commission held negotiations with the provincial party committee and the Ministry of the Metallurgical Industry and decided to start with the scientific and technical aspect of the problem; they organized a special scientific and technical effort which began with intermediate-level test operation involving the processing of 10 tons a day. Through hard work, they overcame numerous scientific and technical problems.

By March 1982 the intermediate-stage test operation had continued uninterrupted for 792 days and had yielded large amounts of scientific data, enabling the entire process to be made functional. In addition it had produced 88 tons of refined tin and 120 tons of crude tin with a value of 1.80 million yuan. Now the intermediate test operation at the 10 tons-per-day level has already been put on an enterprise profit-and-loss basis and is making a small profit.

At the beginning of this year, the State Scientific and Technical Commission, the State General Office of Nonferrous Metals and the Yunnan Province Scientific and Technical Commission signed an agreement with the Yunnan Tin Company for the installation of pilot production facilities for the processing of 100 tons per day of hard-to-classify medium-grade ore. Completion of construction and the beginning of testing are planned for the first quarter of next year. The expected annual yield is 360 tons of refined tin and 430 tons of crude tin, in addition to recovery of some indium, cadmium, bismuth, copper, zinc, arsenic and other useful by-product elements, with an annual output value of 9.11 million yuan and a profit of 3.09 million yuan. The State Scientific and Technical Commission, the provincial scientific and technical commission and the Yunnan Tin Company will jointly provide 7.50 million yuan for the project, with the entire investment to be paid back within 2 1/2 years.

After successful tests at the 100 tons per day level, it is expected that by 1984 it will be possible to reactivate the idle 500 tons-per-day equipment.

In Dachang, Guangxi, another of this country's tin resource bases, the state invested 270 million yuan for the construction of a new plant with a capacity of 4,000 tons of refined tin during the period 1967-1981. But because the technique for mining the ore has not yet been developed, the project has not yet been realized as a productive force and the production plant has turned into a test plant, resulting in serious economic loss. A group is now being organized to carry out a major technical effort.

These examples are not extremely typical. For some time, the failure to accord sufficient importance to key scientific and technical preparations before capital construction is begun has taught us some profound lessons. I believe that scientific and technical work should be an indispensable part of preparatory work for capital construction and large-scale technical modernization projects, that the necessary scientific research should be carried out first that the necessary technical substantiation must be provided, and that all the expenses involved should be included in the total amount for such capital construction or technical modernization projects. This may appear to be costly, but it is money that must be spent, which will be very quickly repaid several times over; it is infinitely more beneficial than suffering the losses which will result from hastily going ahead with construction without carrying out the required scientific and technical work.

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CSO: 4008/226

# SCIENTIFIC, TECHNICAL CONSULTING HELD VITAL TO ECONOMIC CONSTRUCTION

Beijing RENMIN RIBAO in Chinese 22 Jul 82 p 3

[Article by Yang Jike [2799 4764 3784]: "Vital Importance of Scientific and Technical Consulting Work in Economic Construction"]

[Text] In response to a mandate of Minister of the Coal Industry Gao Yangwen, and under the organizational auspices of the Chinese Scientific and Technical Association, a team of over 20 experts from 7 institutions, led by Professor Hua Luokang, recently satisfactorily completed 3 months of deliberations with over 40 experts representing Anhui Province and the Anhui Coal Industry Corporation dealing with optimum plans for the layout, scale, equiping, sequence, and speed of development of the Huainan and Hauibei coal fields. The development plans proposed by the experts not only are suited to the national conditions and economic potential of China, but also provide a scientific basis and reliable technical and economic data for the drafting of the Sixth Five-Year Plan, and for accelerating the construction of energy resources in East China. The July meeting in Beijing, at which the expert team reported on the results of its deliberations to the Coal Ministry, was attended not only by Minister Gao Yangwen and other responsible comrades from various commissions and ministries, but also by State Council member Comrade Zhang Jingfu. The expert comrades were deeply moved that leading comrades among the central authorities have attached so much importance to their technical and economic deliberations concerning this major national construction project.

The completion of these deliberations have even broader effects that in many ways go beyond their significance for economic efficiency and scientific management.

What should these effects include? Here I wish to briefly present my own views for the consideration of comrades engaged in scientific and technical work.

I. There are great opportunities for scientific and technical workers to respond enthusiastically to the call of the party to enter deep into the reality of production with a proprietory attitude and seek work to do.

Last year, during an interview with members of the academic affairs committee of the Chinese Academy of Sciences, Comrade Hu Yaogang called upon scientific and technical circles to "seek work in the reality of production and do your work with an attitude of being your own masters." In response to the call of the party, Professor Hua Luokang led his expert team to the front lines of production, to the worksite of a project in the Huainan coal mines at which a large drill-bit, 9 meters in diameter, is being used to excavate a 600 meter deep shaft. Together with engineers and technical personnel at all levels and the workers, they carried out painstaking investigation of each step, large and small, in the construction of the mine. They also repeatedly used statistical methods, to study 23 mine shafts which were to be constructed. Then they analyzed and compared all of the possible construction plans, finally selecting the most economically rational and feasible plan. Having gone through this intensive work and produced results, the experts had a deep sense that in the reality of production there are very many problems requiring the wisdom and technical abilities of scientific and technical personnel for their solution. And when solutions to these problems are found, the experts are overjoyed. Deeply moved, Comrade Hua Luokang said, "If I can increase production by a single inch, when I'm old and weary I'll face the twilight without a care." Their feelings of joy and willingness to go all out for the four modernizations of the fatherland overflow in these words. The party's faith in the intellectuals has enabled scientific and technical personnel to experience in the midst of actual work the boundless joys of laying a brick for the development of the fatherland, and of being their own masters. This situation makes it quite clear that the Party Central Committee's confidence, concern, and eager expectations have already been welcomed and acted upon by the great mass of scientific and technical personnel. It also makes clear that as long as the hard work of scientific and technical personnel for the national economy attains results, they will certainly receive a high level of appreciation and powerful support from the party and the people. In this respect, there can be no doubt that scientific and technical consulting services play an important intermediary role in the process of transformation of scientific and technical mental labor into productive forces.

However, in the past, because of the disruptive and wrecking activities of the "gang of four," many persons had an inadequate understanding of the potential of science and technology to be transformed into enormous productive forces. In addition, because of unsuitable incentives and propaganda policies, within scientific and technical circles there still exist unhealthy habits which were formed over a long period. Such habits include emphasizing theory and neglecting applications and technology, emphasizing abstract essays and neglecting practical production, emphasizing foreign publications and neglecting investigation of national conditions, emphasizing the high-level, the elegant, the sophisticated, and the new, but neglecting quantity, speed, quality, and economy. For a period of time this caused widespread separation of theory from reality, separation of policies from national conditions. This in turn greatly damaged the development of the national economy. As a result, last year the Central Committee formulated the guiding principle that neither theory nor practice should be overemphasized at the expense of the other, and that the focus should be on the harmonious development of science and technology, the economy and society. An especially urgent appeal was made to young and middle-aged scientific and technical personnel to redirect their scientific research and mathematical work and relate it to the development needs of the national economy. The deliberations just concluded make it clear that the guiding policy principle of the central authorities is correct, and that there is inexhaustible nourishment in the reality of production, enabling any person of lofty ideals to work hard for an entire lifetime. Our scientific and technical workers should actively respond to the call of the party and, like Comrade Hua Luokang, seek out tasks in the reality of production with a proprietary attitude and work to create new habits of dedicating their powers in science and technology to China's vigorous development.

## II. Scientific and technical consulting is extremely important work for intensification and tapping unused potential.

Scientific and technical consulting service began to develop at the behest of Premier Zhao Ziyang. The deliberations and consultations carried out by the committee of experts organized by the Chinese Scientific and Technical Association concerning the development of the Huainan and Huaibei coal fields were the second such event. In 1980, after the conclusion of the first deliberations, Comrade Ziyang pointed out, "Scientific and technical consulting is very important. It is one of the forms in which scientific and technical departments take the road of socialization." Thereafter it developed on a natio--wide scale, and the economic results became obvious. Many agricultural villages and factory enterprises raised output and quality, or turned shortages into surpluses, or avoided acting blindly, or accelerated the speed of development. They gave a concrete and rich content to the guiding policy principles of first keeping to the policy, and second, relying on science. On the present occasion the deliberations on the development of the Huainan and Huaibei coal fields involve' coal resources amounting to several tens of billions of tons, annual production on a scale of several tens of millions of tons, investments on the order of several billion yuan, and a construction period of 15 years. As a result of the comprehensive organization of the entire plan, it was possible to shorten the time required for the work by 2 to 2 1/2 years. In the East China region, which has an ever-increasing shortage in its coal supply, the chain of resulting economic benefits will be worth several tens of billions of yuan, yet the Coal Ministry paid the Chinese Scientific and Technical Association only the negligible amount of a few tens of thousands of dollars to arrange the affair.

It is only necessary to recal' the many large-scale projects in the past which did not undergo inter-disciplinary, thorough and detailed technical and economic substantiation and which were started in haste. The great losses which were incurred because of unsuitable layouts, scale, schedules, and coordination between the departments and the local authorities, is enough to demonstrate the importance of scientific and technical consulting services. This work is indeed and extremely inexpensive and extremely effective way of tapping hidden potential. Experts recognize that it can be used in existing manufacturing enterprises to tap hidden potential, but it is even more important that technical and economic consultation and documentation be carried out concerning layout, scale, schedules, and provision of sets of components before construction projects are begun. It is no wonder that Minister Gao Yangwen, after hearing the report of the team of experts, said to news reporters, "We have learned a lot from these deliberations on the plans. From now on, in coal mine construction in Shanxi and in the Northeast, we must also carry out this kind of technical and economic discussion of all sorts of plans." He also said, "Planning and policy-making must be established on a scientific basis." Scientific and technical consultation are a necessity for economic policy-making in the Coal Ministry. Comrade Pei Lisheng [5952 7787 3932], secretary of the party group of the Chinese Scientific and Technical Association, said, "This shows that the leading cadres have taken a big step forward along the road from empirical leadership to scientific leadership. In fact, not only the Ministry of the Coal Industry, but other ministries and departments such as those for electric power, light industries and textiles, chemical engineering, petroleum, steel, machinery, transportation, and communications, all have this need. If all leading cadres at all levels in government ministries and departments follow Comrade Gao Yangwen's example and entrust the work of carrying out thorough and detailed technical and economic deliberations and consultations to experts, then our four modernizations will certainly show increased quantity, speed, quality, and economy.

III. Consulting services by nongovernmental personnel offer many advantages.

The 7 academic and research institutes which took part in this consulting and documentation work were all nongovernmental scientific and technical organizations. The advantage of this circumstance was that they were all relatively detached from subordination and that their thinking was not fettered by the ministries and departments, or by the local authorities. For this reason, the great majority were able to liberate their thinking. Taking the greatest benefit to the nation and the people as their point of departure, they were able to express their own opinions objectively and scientifically, to say whatever they wanted, and to pool their ideas effectively. This had the effect of enabling the policy-making leadership comrades to "discover the truth by hearing both sides". I have heard that in the past some other commissions and ministries have also set up expert advisory groups, but these had little effect. For example, in the past the State Energy Commission also set up an expert advisory group and invited many experts, but we never heard what they accomplished. I think that one of the reasons is that these experts were enveloped by the guiding thoughts determined by the leadership with regard to technical and economic questions. They had little room in which to operate, they could not say whatever they wanted to say, and there was the great deal of subjectivism and centralism, but not much science and democracy. As a result, there were a lot of passive yea-sayers and not many solid workers among the advisors, and it was difficult to transform their wisdom into productive forces. A second reason is that the management method which they used was, in essence, that of secure positions or "iron rice bowls", and equal compensation for all or "everyone eating from the same big pot." It made no difference whether you worked or not; therefore the nominal participants were many, but the real workers were few. One of the reasons why the deliberative work on developing the Huainan and Huaibei coal fields achieved such good results in 3 months is that the contract and responsibility system was used. A contract was signed between the Coal Ministry and the Chinese Science and Technical Association's Consulting Services Department. The contract specified assignments, expenses, and schedules. The result was that the time needed for the work was decreased from 6 months to 3 months, while assuring of both quantity and quality. This shows that shifting consulting and advisory work to nongovernmental personnel has its own inherent advantages. It can be seen that the contract and responsibility system, which is so effective in scientific and technical consulting work. By the way, the team of experts headed by Hua was composed mostly of middle-aged experts, and when they first arrived everyone was extremely doubtful of their abilities. However, the high level of their learning, the outstanding results, and their enthusiasm for struggling day and night, finally convinced everyone from minister to worker, so that they won very high praise.

Furthermore, we know that in the various departments there is still the shortcoming of specialist over-simplification. This is especially true of large-scale construction projects. For example, in the development of the coal fields, it is not enough to deliberate on excavations. To illustrate, the crucial problem in the development of the coal resources of Shanxi and Inner Mongolia is not excavation but transportation. In the construction of steel industry bases, it is necessary to coordinate coal, transportation, and electrical power. Therefore it is necessary to carry out joint inter-disciplinary deliberations in order to seek the best plan for each department and to coordinate construction step-by-step. This is possible only through a meeting of specialists from many disciplines in one place, organized by the Chinese Scientific and Technical Association. Thus, it can be said that assigning scientific and technical consulting services work to nongovernmental personnel and combining developing and exploiting our mental resources, is very inexpensive and offers many benefits.

IV. Technical and economic deliberations involve questions of reform of the economic system.

In the course of the detailed work on shortening of the construction time of the coal mines, statistical calculations were made for the mines on which work was to begin. They were based on a summary analysis of past experience, the design documentation, and the relevant specified and actual speeds. Feasible plans were put forward which shortened the time required for the large scale mines to 5.5 or 6 years, while the especially large projects were shortened to 7.5 or 8 years. However, this speed was calculated from the average rate of advance of tunnels through rock over the past 11 years, i.e. 69 meters per month. There are still certain untapped potentialities. Everyone recognizes provided reforms of the economic system are properly implemented in accordance with the principles of distribution according to work, and more pay for more work, making use of the contract and responsibility system, then it may be possible to tap this hidden potential and further shorten the construction time for the mines.

Moving out from microeconomics to macroeconomics, after the comrades from the East China Regional Commission of the China Energy Research Association who participated in the consulting work had completed their investigation and research, they put forward some further suggestions concerning reform of the energy sector of East China's economic system. They found that the energy economy is basically a system in which management is highly centralized in the responsible national departments, and that authority, responsibility, and benefits are not well integrated. This kind of system is not advantageous for mobilizing the enthusiasm of the energy producres (including regions, enterprises, and workers). It obstructs the speedy development and exploitation of energy. A reform of the system is imperative in order to satisfy the needs of economic development. The key question of reform, presupposing resolute implementation of the planned economy, is how to correctly handle the relationship between the economic interests of the central authorities, the local authorities, the enterprises and the workers in accordance with the principle of integrating authority, responsibility and benefits. The experts suggested that in the development of East China's energy resources, the area should continue to fulfill the energy-related capital construction, production, and overall allocation specified in the current state plan with existing capital and output distribution channels, but that the area should be able to independently organize human, financial, and material resources, and, with the approval of the state, carry out further development of coal mines outside of the state plans. It should be allowed to raise capital through various methods. For example, the state and the producing area might combine capital resources for joint development, with the product divided in proportion to the shares. Or the producing area might set up shares and invite bids, developing inter-province joint management, with the product divided in proportion to the shares. Or the producing area might act as the principal and organize a multi-industry combined operation (such as a combination of coal with the chemical industry, electric power, coal gas, or building materials,etc.) and carry out combined development and diversified operation with various kinds of energy resources. Or capital for construction might be raised within the producing area, and an intraprovincial operation organized. Or foreign capital might be brought in to engage in compensatory trade. Thus, by using all of the various forms, with flexibility in generating, putting together, and using capital, and by using fair and reasonable methods for distributing the earnings and the product, such as inviting the China Financial Accounting Conculting Corporation to give advice and do unbiassed distribution accounting, it is possible for the central and the regional authorities, the enterprise and the workers, to "all share in the credit", and "all share in the benefits". This will enable all four to enthusiastically and industriously combine their efforts and set out to attain the common goal. Construction for the four modernizations and the vigorous development of China depend on it.

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CSO: 4008/210

## DEVELOPMENT, IMPROVEMENT OF S&T WORK IN NORTHEASTERN PROVINCES DISCUSSED

Beijing RENMIN RIBAO in Chinese, 19 Aug 82 p 3

[Article by Zhang Dengyi [1728 4098 5030]: "A New Phase Has Appeared in S&T Work in Three Northeastern Provinces"]

[Text] For over one year, the three northeastern provinces of Heilongjiang, Jilin and Liaoning have taken effective measures, resolutely strengthened leadership, and vigorously implemented our nation's new policy to develop science and technology. Scientific and technical work has greatly improved and a new lively phase has emerged.

I. Resolutely Strengthening the Party's Leadership in Scientific and Technical Work. The provincial committee, the provincial government and the many subordinate local, city and county level leaders of the three northeastern provinces have included scientific and technical work in the daily agenda of important business. The Shenyang City Committee has decided that each month, the city committee and the city government will jointly hold a city-wide meeting of scientific and technical offices. The heads of the city, local and county committees of Qiqihar, Jilin and Dalian all personally emphasized scientific and technical work. The Benxi City Committee established a special city science and technology leadership group headed by the first secretary. Siping City Committee first secretary Yang Xunzhang [2799 0534 4545] led a group of people of the city committee in promoting scientific and technical work, the financial departments provided strong support and the city's scientific and technical work flourished.

II. The Role of Science and Technology in Stimulating Economic and Social Development Has Become More Prominent. The three northeastern provinces are China's heavy industry base. In the national economic readjustment, these three provinces have emphasized developing the role of science and technology, have vigorously stressed the study of production techniques, have popularized the achievements of applied science and technology, and have carried out technical reform and developed new products so that the once sagging heavy industry has been revived. The output value of heavy industry in Liaoning Province during the first half of this year showed an increase of 6.7 percent over the same period last year. According to statistics of the eight industrial bureaus of Shenyang City, from

January to May of this year, 344 new products that relied on science and technology were completed, increasing output value by nearly 84 million yuan, and increasing profit tax by more than 10 million yuan. Harbin City popularized the application of 84 major scientific and technical achievements this year. They are expected to create an output value of 100 million yuan and increase profit by 30 million yuan, constituting 40 percent of the economic growth of the city this year. Siping City, relying on science and technology developing potential, renovation and improvement is building eight industrial production lines. The city has already produced 500 new products with different specifications; 300 of them were produced by directly popularizing scientific research achievements.

III. A Group of New Developments That Closely Combine Scientific Research With Production Has Emerged. The three northeastern provinces carried out bold experiments in keeping with their own situations and created integrated scientific research and production bodies, a responsibility system for linking technology with production, technological exchange and consulting services. Enterprises have engaged in scientific research, the provinces have conducted large area comprehensive technical experiments in agriculture, and integrated scientific and technological development has been undertaken. They not only have realized visible economic benefits but have also obtained the preliminary experience to reform the science and technology system and the economic system. Heilongjiang Province stressed the comprehensive utilization of soybeans and organized the scientific research secotr, the production sector and the commercial sector to carry out a whole series of scientific and technological development in breeding, cultivation and processing of soybean products and sales. This year it has realized its first results. After full-scale production begins, soybean processing alone can change the present loss of 900 yuan per ton to a profit of 2,000 yuan. It will also provide a large amount of nutritive protein foods and medicinal and dietary supplements to the market. Liaoning Province has established 10 joint scientific research and production entities with the participation of 90 factory enterprises, 5 universities and 25 research institutes.

Scientific research, production and education have been closely combined. The development cycle from scientific research to production has been shortened and economic benefits have been improved. Statistics for just two joint scientific research and production units in Dalian show that over the past two years, they have increased their output value by over 23,000,000 yuan and increased their profit tas payments by nearly 5 million yuan.

IV. Pay Attention to the Role of Policy in Developing Science and Technology. During the past 1 or 2 years, while overcoming scientific and technical difficulties, the three northeastern provinces have relied on the organizational personnel of the provincial science committee and the science committees at each level to conduct surveys and studies, provide forecasts and documentation, and propose suggestions regarding major problems related to the strategy of the regions' economic and social development, the development and utilization of resources, the development of superior industries, market changes, and ecology and environmental protection. Relevant specialists were organized by the Heilongjiang Provincial Science Committee to propose technical policies for the food industry and for rural energy resources and energy conservation and to suggest development plans for the Sanjiang Plain on the basis of extensive documentation; they provided many valuable policy suggestions to the provincial committee and the provincial government. The Jilin City Science Committee organized specialists to provide documentation and propose suggestions concerning the future economic development of the city and major current scientific, technical and economic problems. The city government accepted their suggestions and organized 36 enterprises subordinate to the city to establish liaison with the Changchun Branch Academy of the Chinese Academy of Sciences, and to work together to tackle 49 major technical and economic problems in the city. The Fushun City Scientific and Technical Consultants Committee, composed of specialists from all sectors, conscientiously undertook an investigation of scientific and technical policy and documentation and forecasting work relative to the city's development goals. They realized outstanding achievements in the comprehensive utilization and development of petroleum, peat and surplus heat. This committee has become the policy advisory agency of the city committee and the city government in leading scientific, technical and economic work.

V. Make Use of Scientific and Technical Committee, Strengthen Scientific and Technical Management. The three northeastern provinces have paid considerable attention to developing the role of provincial scientific and technical committees, and have taken charge unified administration and coordination of scientific and technical work in the provinces. The scientific and technical committees of the three provinces have done much outstanding and effective work under the leadership of the provincial committee and the provincial government.

To strengthen scientific and technical management and promote the development of scientific and technical work in the three northeastern provinces, the provincial committees and governments have drawn up many management measures and regulations, and continue to carry out the nation's new policy of developing science and technology. During the last 2 years, in Shenyang Alone, 14 measures and regulations have been issued, including the "Provisional Work Measures of the Scienficic and Technical Committee in the Urban Area of Shenyang City", the "Provisional Management Measures for Organizing Scientific and Technical Work", and "Provisional Working Measures for the Research Institutes Subordinate to the City". The implementation of these methods is producing good results. For example, after trial implementation of the "Opinions on Strengthening the Technical Manpower of Medium and Small Enterprises and Collective Enterprises", Shenyang City now has transferred over 100 workers, who are middle school or vocational school graduates to medium and small enterprises and collective enterprises to conduct technical work after examination. At present 400 more are being processed, and it is expected that the number will reach 1,000 by the end of this year.

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CSO: 4008/221

# PROPERLY MANAGE SCIENTIFIC, TECHNICAL ACHIEVEMENTS

Beijing JIANKANG BAO in Chinese 7 Oct 82 p 3

[Article by Zhou Minjun [0719 2404 0689]: "A Preliminary Discussion of the Significance of Managing Scientific and Technical Achievements"]

[Text] The research activities of modern science and technology underwent three developmental stages, viz., scientists doing free research; scientific research personnel organizing laboratories and research institutes for given goals and conducting organized and collective research; studying crucial problems under unified arrangements or coordination by the state in a planned way, or even by means of international cooperation. The larger the scale of scientific research, the larger will be the number of achievements. According to some estimate, the number of scientific discoveries and inventions in the past 10 years is greater than the total of the past 2,000 years, and that of the next decade will double that of the past decade. Even though the achievements are published in large volumes of scientific and technical literature, a considerable portion of them is scattered among the units or individuals and not fully exchanged and applied. Therefore, strengthening the collection and management of scientific achievements has a crucial significance in promoting the development of society, the economy, and science and technology.

## Speedier Utilization Requires Better Management of Achievements

The greater speed of the renewal of knowledge in recent years is reflected in the accelerated cycle of scientific research from the discovery of principles to the introduction and application of achievements. Take the following instances: It took almost 150 years from the discovery of positive and negative charges in the 19th century to the establishment of the electrical industry, 112 years from the invention of photography to its application, 70 or 80 years from the discovery of semiconductor to its application, 56 years from the invention of telephone to its extensive use, less than 10 years from the discovery of nuclear fission to the explosion of the first atom bomb, and less than 10 years from the discovery of laser to its application. The shortening cycle from discovery to application is closely linked with the development and mutual permeation of the different branches of learning. The development of medical science has been greatly influenced by that of other sciences, e.g., the development of electronics and laser. Therefore, the achievements of scientific research must be concentratively managed, both management classified according to the branches and comprehensive management in consideration of the overlapping characteristics of the different branches. By so doing, it will enhance the impact of the achievements to the maximum, while also avoiding detours in the study of new subjects and shortening the time between research and application.

## Managing Achievements Is a Crucial Link in Managing Scientific Research

There is a definite procedure in scientific research, and the procedure for applied basic research work is generally as follows: Determining the project or task--scientific research design and demonstration--experimental research--evaluation of achievement and its introduction and application. The procedure for applied research is generally as follows: Determining the project or task--scientific research design and demonstration--experimental research--intermediate plant (workshop) or site--evaluation of achievement and its introduction and application. The summarizing procedure of research work may also be simplified as follows: Planning--summarizing and exchange--achievement. The management of scientific and technical achievements is a crucial link in the management of scientific research, and the quality of this task directly influences the enthusiasm of the scientific and technical personnel, the efficiency of scientific research work, the level of achievements, the time required to "materialize" scientific research and the impact on the national economy. Though the management of achievements is the final stage of scientific research management, it is the substance manifesting the conversion of scientific research into productive forces, and scientific achievements have a feedback effect on future scientific research activities, such as forecasting scientific research, deciding on research plans and selecting subjects.

## Better Management of Achievements Benefits Discovery and Growth of Talents

Like a pair of twins, achievements and talents are closely linked and inseparable. Only when there are high-quality talents will there be high-level achievements and, to have a large number of high-level achievements, there must be a group of high-quality talents (superior first-rate personnel). The level of scientific and technical personnel is, to a large extent, determined by their achievements, and the emergence of talents is marked by high-level achievements. In daily work, we often uncover new talents, or intensify our understanding of their growth, through their achievements. Among the many factors for the discovery and growth of talents, achievements are a crucial aspect. The management of talents is an important part of scientific research management, and its core is the evaluation of talents. One crucial component of evaluating scientific and technical personnel is their achievements (including both quantity and quality). Therefore, the larger the number of talents, the larger will be the number of achievements and the faster talents are discovered, the faster will achievements be made.

## Scientific and Technical Achievements Reflect Spiritual and Material Civilization

Premier Zhao Ziyang pointed out at the fourth meeting of the Fifth National People's Congress that one aspect of spiritual civilization is the developmental scale and level of education, science, culture, art, public health and physical education. The overall scientific and technical achievements reflect the scientific and technical developmental scale and level of a country or region, and a certain outstanding or crucial achievement reflects the scientific level of a country or region from a certain angle. Therefore, scientific and technical achievements are an aspect reflecting the spiritual and material civilization of a country or region.

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CSO: 4008/13

## SCIENTIFIC INVENTIONS INCREASE ECONOMIC RESULTS

OW241209 Beijing XINHUA Domestic Service in Chinese 1153 GMT 19 Oct 82

[Excerpts] Beijing, 19 Oct (XINHUA)--Editor's note: Quadrupling the total industrial and agricultural output value by the end of this century partly depends on technical progress. Economic results achieved by applying numerous inventions to production show that the latent capacity of technical advancement to increase production is enormous. All enterprising scientists and technicians must plunge themselves into the four modernizations campaign, organize and concert their efforts to tackle technical bottlenecks to solve difficult problems, and widely popularize new techniques and research results. (end editor's note)

A XINHUA reporter learned from the State Scientific and Technological Commission that scientific and technical inventions awarded and commended by the state have created great economic results in recent years after being applied to industrial and agricultural production and economic construction. A number of them have increased revenues or saved expenses for the state in terms of 10 million yuan yearly. This demonstrates the powerfulness of science and technology after being turned into productive force.

The fine corn variety "Inbred System 330," which has been recently given the first-class award by the state, is the most widely adopted. A total of 36 hybrid varieties have been obtained by crossing it with other inbed systems. These varieties have been popularized over 50 million mu of farmland throughout the country. Their average per-mu output is 700 jin, increasing China's yearly total corn output by 4.2 billion jin and its total output value by 500 million yuan.

High yield and disease resistant sweet potato variety "Xushu 18" also made a great contribution to agricultural production in recent years. It has been popularized on 12 million mu of farmland in six provinces. Its per-mu output ranges from 3,000 jin to 4,000 jin, increasing yearly income by 150 million yuan.

The many scientific and technical inventions applied to the industrial front have also played an important role which testifies that new techniques are absolutely necessary for effecting a brand new situation in industrial production. For instance, the Panzhihua Iron and Steel Company in Sichuan employed a new technique to isolate titanium and vanadium from paragenetic ores and has since been able to hand in to the state a yearly profit tax of 130 million yuan.

CSO: 4008/37

## CHANGE IN FOCUS OF TECHNOLOGY IMPORTS CITED

Beijing RENMIN RIBAO in Chinese 15 Oct 82 p 2

[Article: "Our Country's Import Work Has Undergone Two Marked Changes"]

[Text] Since the 3d Plenary Session of the 11th Party Central Committee, our country's import work has been carried out in a practical and realistic manner in accordance with the condition of our country, and has undergone two marked changes: one is import of single-item technology instead of large-scale complete sets of equipment; and the other is using imported technology to serve mainly the technological transformation of existing enterprises instead of serving newly constructed enterprises.

In the last 3 years, we have imported 158 single-item technologies from abroad for our country's machine building, shipping, electronics, coal, electrical, posts and telecommunications, chemical industry, textile and light industry sectors. Generally, they were at an advanced international level and were urgently needed in our country's industrial production. Statistics show that the share of imported individual technological items provided for by the state plan is the total volume of technology and equipment import rose from 1.2 percent in 1979 to 28.6 percent in 1981. The share of imported technology and certain key equipment for technological modernization of existing enterprises in the total volume of import rose from 0.7 percent in 1979 to 36.7 percent in 1981.

Since the founding of New China, our country has always primarily imported complete sets of equipment. This was necessary during the period of time when our country's industrial basis was relatively weak. But in 1978, we blindly imported large numbers of complete sets of equipment, which surpassed our country's ability to handle them. At the same time, owing to the fact that in some projects the distribution of equipment was not organized well, we failed to give full play to the capacity of the domestic machine building industry. Since the 3d Plenary Session of the 11th Party Central Committee, while firmly implementing the open-door policy, our country has practically and realistically taken our country's situation into consideration, has strengthened the management of import work , and has strictly controlled the import of large scale complete sets of equipment. It has adopted such methods as requiring the purcahse of a permit to use specialized technology, having the other party provide counseling and technological service, and carrying out cooperative production in order to import appropriat advanced manufactured items or technology and manufacture the products at home. These imported technologies typically involve small projects, little expense and fast results, which are more suited to our country's capacities. Also, these medium-size and small projects are mainly used in the technological transformation of our existing enterprises, and the results are obtained in 1 to 2 years, or 3 years at the latest. Specific results include the following:

First, they have raised the technological level of the machine building departments at home, promoted the upgrading and replacement of products and accelerated the development of product variety at home. For instance, the medium-size and small steel mills at home urgently need a kind of small continuous square blank casting machine, but some key technologies for manufacturing containers casting machines had not been mastered for years. In 1979, the former First Ministry of Machinery and the Ministry of Metallurgy imported manufacturing technology from abroad and also cooperated with foreign manufacturers in producing complete sets of small size continuous square blank casting machines, thereby raising the standard of the machine building industry at home. Our country is now able to produce complete sets of this advanced equipment.

Second, the economic results are more obvious in importing technology than in importing equipment. In importing equipment, we spend a sum of foreign exchange on a set of equipment. By spending the same amount of foreign exchange on importing technology and purchasing some key equipment and testing apparatus, we can very rapidly develop our productive capacities and introduce them into production as a group, thus reaping continuous benefits. This method of buying a hen to lay eggs can satisfy domestic needs in many areas. A few years ago, our country imported complete sets of equipment for producing chemical fertilizer and chemical fiber. Every year, we spent over 1 million yuan on importing machinery seals. In 1979, the Tianjin seals plant imported the technology to manufacture seals. The following year, it began production on a large scale. In 2 years, the foreign exchange it saved was more than 2-1/2 times the expense in importing the technology.

Thirdly, through importing technology of all kinds of projects, more enterprise management personnel and technical personnel have broadened their perspectives, enlivened their thinking and gained experience in drawing inferences about other cases from one instance. For instance, the Shanghai Gufeng Machinery Plant learned the foreign method of modular design, completed the design programs for 11 products, and accelerated the speed of design by three to four times.

Importing technology is still a new task in our country, and there still exist some problems. For instance, feasibility studies of imported items are still incomplete. In the work of digesting and absorbing imported technology, we still lack effective organizational leadership. Also, the cases of redundancy in imports still occur. These problems await further resolution in the future.

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CSO: 4008/12

# SCIENTIFIC, TECHNICAL ASPECTS OF SPECIAL ZONE DEVELOPMENT DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Sep 82 pp 6-8

[Article by Yan Zexian [7346 3419 6343], Institute of Philosophy, Huanan Normal Institute: "Science, Technology and Development Models for Special Zones"]

[Text] The scientific and technical problems of developing special zones seem not to have been accorded much importance thus far. On the one hand, scientific and technical problems have not yet been put on the agenda in the practical work of developing special zones, on the other hand, theoretical research on special zones has dealt mostly with economics and very little with science and technology. Such problems as the place and role of science and technology in developing special zones in China, the relationship of science and technology to special zone development models, and the ways of using science and technology to increase the social and economic benefits realized by building special zones, have received very little specialized discussion. But these are problems that must not be ignored. In the first place, construction of special zones is inseparable from science and technology, and consideration should be given to using the latest scientific and technical achievements in such areas as overall planning of special zones, development models for them, and specific management; second, one of the important purposes of the special zones is the import of foreign science and technology to help develop our own country's science, technology, economy and society.

The present article presents some of the author's views on the relationship of science and technology to special zone development models as exemplified by the Shenquan Special Zone. Our country began to experiment with the development of special zones in such places as Shenquan and Zhuhai, Guangdong Province, in 1979. Why are they called special zones? What is "special" about them? When work on special zones began, there were different views on these points. Some people believed that special zones involved "special policy and flexible measures"; others believed that special zones were just another step forward in reform of the national economic system; and still others believed that special zones were similar to foreign "processing and export zones" or "free trade zones." It is obvious that when special zones had just emerged as a new phenomenon they were not fully understood. Understanding of this question has passed through three main stages in the short

3 years' existence of the Shenquan Special Zone: it has been considered to be an "export special zone," an "economic special zone," and an "integrated special zone."

The "special export zone," with its processing and export orientation, was unable to play a very positive role in the import of science and technology, because processing and export zones emerged in response to the requirements of the third technical revolution. This revolution stimulated the advanced industrialized capitalist countries to focus on knowledge-intensive industries based on advanced science and technology, relegating labor-intensive industries to the undeveloped Third World. In this way processing and export zones actually became "branch factories" through which foreign countries could engage in labor-intensive industries. Even though the countries and regions which had processing and export zones made it clear that they wanted to import advanced scientific-technical and management knowledge, the results were always minimal, and in some cases, as in the processing areas of Singapore and Kaohsiung, Taiwan, following the 1970's foreign capital investments in simple labor-intensive industrial enterprises were no longer welcomed.

In the case of Shenquan Special Zone, the main areas of processing of imported materials were electronics, clothing, woolens, toys, rubberized thread, plastic flowers, watchbands and chains, and other light industrial production. Foreign merchants primarily supplied the materials on a consignment basis, particularly for assembly. Most of these operations and processes involve simple, repetitious work, and accordingly it was difficult to come in contact with advanced scientific and technical knowledge and industrial processes, and the workers had little chance to learn advanced production technologies. As regards enterprise management, because processing and export zones were in the nature of "branch factories" for foreign countries, most of the important decisions regarding production and marketing were made by the foreign parent plants, and the processing and export units were in the position of industrial units which contracted for international processing on an order basis, so that our managers had little opportunity to participate in and study major management decisions.

Experience has already shown that simple processing and export zones are not capable of importing advanced science and technology and enterprise management methods.

The "economic special zone" imports technology on a greater scale than does the "special export zone" and uses a greater variety of investment forms. By means of cooperative, jointly owned and independently owned and managed factory enterprises it can import some advanced science and technology and learn certain management methods. But the nature, degree and range of technology import are far from being able to meet our country's objectives and needs in developing special zones.

The model which is truly able to import advanced science, technology and management methods on a large scale is the "integrated special zone" model.

It should be designed to integrate scientific research, culture, education and commerce and should include international scientific research organizations, science and technology centers, universities and the like: this type of special zone opens broad prospects for large-scale import of science and technology.

The development model for special zones is determined primarily by their strategic purpose; the development model is the form and means by which the strategic objectives are realized.

1. The Strategic Objectives of Special Zones in China. We believe that these objectives primarily involve the question of how the concept of the "integrated special zone" is to be understood, i.e. integration at what hierarchical level, and integration to what degree? Most people still think of integration only from the economic viewpoint, which is a one-sided approach. In strategic terms, integrated special zones are integrated centers of interchange which in external terms are opened up to the entire world and in domestic terms are integrated test bases for the construction of socialism. This should be our country's overall strategic objective in developing special zones.

"Integrated centers of interchange" refers to interchange between the district and other countries in terms of socialist politics, economics, culture and science. Accordingly, the economic construction of special zones should be put on a par with political, scientific, educational and cultural construction. The political and legal provisions for special zones must embody the rights of a socialist country and the system of the people's democratic dictatorship; the economic construction of special zones must embody the material culture of a socialist country; and the scientific-technical and cultural-educational construction of special zones must embody the spiritual civilization of a socialist country.

"Integrated test base" means that it makes thorough use of the special zone's advantageous geographical position and conditions for opening to foreign countries to import foreign capital on a large scale on a preferential basis, to absorb advanced foreign technology and management methods on a large scale, and to train personnel for our country's modernization on a large scale. At the same time, studying and assimilating imported science, technology and management within the special district and popularizing it on a practical basis within our country will make the special districts into base areas for our country's economic takeoff, scientific and technical development and personnel development, and into testing bases for the further advancement of socialist construction.

2. The Optimum Development Model for the Special Zone. We believe that science and technology should have an extremely important place among the strategic objectives of developing special zones. Accordingly, it is an error to ignore science and technology in considering development models for the special district. Leading comrades of the Central Committee and the State Council have frequently pointed out that this country's planning should

not be merely planning for economic development, but should also take account of scientific-technical development and social development, and that an effort should be made to draw up plans which embody the policy of coordinated scientific-technical, economic and social development. As test bases for socialist construction, special zones should be a step ahead in coordinated scientific-technical, economic and social development; they should achieve results and obtain experience that can be disseminated.

Given the current situation of the special zones, the main problem of coordinated development is the role and function of science and technology, but it has not received sufficient attention.

Scientific, economic and social life are the three major areas of human activity and existence, and under present conditions they have become an interpenetrating, inseparable "threefold unity." In particular, modern science and technology have increasingly penetrated into all aspects of economic and social life, and have become important factors promoting economic and social development. Their effect on economic and social development is no longer limited to the application of specific scientific and technical results in production; they have become a kind of knowledge production and a knowledge system which is exerting an increasingly important influence on the country's economic and social policy. For example, in building special zones, the determination of their strategic objectives, the selection of development models for them, the reform of economic and social structure, the negotiation of agreements with foreign merchants, and feasibility studies of scientific and technical import projects, all depend on science and technology.

To summarize, our country's special zones should not be seen simply as economic special zones, but instead the "threefold unity" of coordinated scientific-technical, economic and social development should be considered, an integrated balance struck, and arrangements made in terms of an overall plan. Science and technology should be treated as an important means for the economic and social development of special zones so that reliance on them will become a strong internal requirement for the economic and social development of special zones and so that development of science and technology will become an organic component of the districts' economic and social development. At the same time, the scale and speed of scientific and technical development of special zones and the human, material and financial resources devoted to them must also be considered in terms of the needs and potential of the special zones' economic and social development.

Only by implementing the policy of coordinated scientific-technical, economic and social development in the actual development of special zones will it be possible to make them develop steadily and in a healthy fashion according to the best model and rapidly achieve their strategic objectives.

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CSO: 4008/17

# MORE ATTENTION TO SCIENCE, TECHNOLOGY URGED

Shenyang LIAONING RIBAO in Chinese 9 Jan 83 p 1

[Editorial: "Increase the Consciousness of and Sense of Urgency About Relying on Science and Technology"]

[Text] This province's science and technology awards meeting has victoriously concluded. We warmly congratulate the scientific and technical front and the many prizewinning scientific and technical workers.

Not only does this meeting give great encouragement to scientific and technical personnel in this province, it also provides a vital lesson for all people in the province. What lesson? To believe in, utilize and rely on science and technology.

Consider: are not the various scientific and technical results which won prizes vital educational materials?

The prizewinning new Hunjing No 1 rice variety has an average yield more than 10 percent greater than the main varieties currently planted in Liaoning. If it comes into widespread cultivation here it could increase annual grain output by more than 100 million jin each year.

A prizewinning new technology for increasing the recovery rate from the southern Xinglongtai oil-bearing strata is capable of increasing the daily yield of older oil wells by 46.5 percent, equivalent to an annual output value of 25 million yuan.

A prizewinning pressurized oil-conserving slab heat treatment furnace can decrease fuel oil consumption per ton of steel from 143 kilograms to 58 kilograms. Since it went into production in 1979 it has already saved more than 30,000 tons of fuel oil.

Other examples are too numerous to mention. According to statistics from the relevant departments, of the 211 prizewinning achievements, 96 percent are already being put into extensive use in production and are creating more than 350 million yuan worth of value. This is just the beginning: as they go into still more widespread use, their benefits are sure to expand even further--and these are just the results achieved during 1981. As scientific and technical work continues to develop, it will unquestionably produce more and more excellent results, resulting in inestimable benefits for the national economy and for social development.

Science and technology are productive capacities. As scientific and technical achievements are applied in production, they will make it expand even faster. In modern production, science and technology are entering the production process more and more widely and deeply. In other words, their contribution to increasing labor productivity is steadily growing. Currently 60 to 80 percent of the increase in labor productivity in some of the developed capitalist countries comes from new science and technology, while some new production sectors spring entirely from science and technology. In a certain sense, modern production is science-and-technology-based production. The equipment and tools which it uses are largely embodied science and technology, as are its products, and the persons involved in modern production must have the requisite grounding in science and technology. The conclusion is very clear: modern production must go hand in hand with science and technology, and there can be no modern production separate from science and technology.

For us, today, without science and technology there would be no four modernizations. If we want to gradually achieve modern industry, agriculture, and defense and modern science and technology, is not our main concern to equip these fronts with science and technology? In other words, modernization primarily involves transformation by means of modern science and technology. The importance of science and technology to our implementation of the four modernizations is the same as the importance of the army to our carrying out of the democratic revolution in the past. During the period of the democratic revolution, if we had not had the people's army to conduct the revolutionary war for the overthrow of the "three great mountains," we would have had no revolutionary victory or any of the things which were achieved by the people; similarly, if today, in confronting the new historical task of carrying out social modernization, we do not solve the problem of coming to understand the importance of science and technology and do not solve the problem of all having all branches conscientiously rely on them from top to bottom, we will not be able to achieve victory in the four modernizations.

The current problem is that some cadres' understanding of the importance of science and technology and reliance on it is extremely far from meeting the requirements of the new situation. This is an acute contradiction which urgently requires resolution. It is principally expressed in one of the following ways. (1) Some comrades have long been serving the "iron rice bowl" and eating from the "one big rice pot," and they lack both internal incentive and external pressure to use new science and technology to improve production and the economic situation in their own areas, systems or units, and they feel no sense of urgency about it. (2) Some comrades do not understand science and technology, are not "initiates," do not comprehend its immense effect and influence in developing production and have no idea where to start in relying on science and technology in their own areas, systems or units. (3) Some comrades have long been accustomed to relying on the extensive mode of expanded reproduction, and as soon as the topic of expanding production comes up they want to start new construction projects and build new facilities; they are unwilling to rely on intensive factors and on science and technology. (4) Some comrades' understanding is one-sided, and while they busily concern themselves with immediate tasks, they treat science and technology as "distant water which cannot quench a present thirst" and as a "soft task"; or they are unreliable and may give lip service to its importance but forget to do anything about it. To summarize, in addition to the hindrances to reliance on science and technology which spring from the system or policy, these comrades have not subjectively liberated themselves from the fetters of the narrow small-producer outlook or from the errors of "left" ideology and have not rectified the long-standing error of holding education, science and culture in low regard. This is a difficult problem of ideological education that faces party organizations at all levels in our province. Only by helping people to solve thoroughly the current problem of correct understanding in this area will it be possible to increase the awareness of and sense of urgency about relying on science and technology and thus truly raise science to the level of a key strategic concern, tackling it vigorously as the key to the four modernizations.

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CSO: 4008/50

## SUCCESS OF FOUR MODERNIZATIONS LIES IN RAISING SCIENCE, CULTURAL LEVELS

HK151225 Beijing RENMIN RIBAO in Chinese 8 Nov 82 p 5

[Article by Bai Yumin [4101 3768 3046] and Jiao Fenggui [3542 7685 6311]: "Raise the Scientific and Cultural Level of the Whole Nation"]

[Text] Summary: Scientific and cultural development bears directly on the success or failure of the four modernizations. It is impossible to build socialism smoothly without highly-developed science and culture and without the upgrading of the scientific and cultural level of the whole nation. Also, it is hard to imagine that in a scientifically and culturally backward country full of illiterate people, people can rid themselves of ignorance and that noble ideological and moral integrity can be maintained throughout our society. Scientific and cultural construction must be carried out in the whole of society. In order to build highly developed socialism, we need millions and millions of skilled workers, peasants and other laborers with socialist consciousness and modern scientific and cultural knowledge; we need thousands and thousands of experts of all kinds with modern scientific, technological and cultural knowledge; and we need hundreds and hundreds of learning cadres with a knowledge of modern economy, modern science and technology and modern business management. It is an important task on the ideological front to mobilize and guide the millions and millions of the masses to create an upsurge of learning science and culture and to carry out the demand of the CPC Central Committee to raise the scientific and cultural level of the whole nation. [end of summary]

In his report to the 12th CPC Congress, Comrade Hu Yaobang called for the upgrading of the scientific and cultural level of the whole nation. This is a conclusion drawn by the CPC Central Committee after summing up the historical experience of economic development in China and other countries in the world, and is of great importance to the realization of the four modernizations, and the building of a socialist power with a high degree of civilization and democracy.

### The Upgrading of Our Scientific and Cultural Level Is an Important Condition for the Realization of the Four Modernizations

Scientific and cultural development bears directly upon the success or failure of the four modernizations. It is impossible to build socialism smoothly without highly-developed science and culture and without upgrading the scientific and cultural level of the whole nation. Therefore, it is pointed out in the report to the 12th CPC Congress that the development of the causes of education and science should be considered as an important point in China's construction for modernization.

Science and technology are productive forces. Since the appearance of modern science, there has been a rapid development in productive forces. If the upgrading of productivity for thousands of years in the past depended mainly on manpower, animal power and natural conditions, with science in a less important position, then the upgrading of productivity nowadays depends mainly on science. According to relevant research reports, in the early years of the century, only 5 to 20 percent of productivity growth depended on science and technology, but now 60 to 80 percent of productivity growth depends on it. The development of modern science and technology has made the relationship between science and production closer, and science and technology as productive forces are becoming more and more powerful.

It is due to this that countries all over the world are increasing their investment in intelligence and vigorously developing the scientific and educational causes. The United States spent only $1 billion on scientific research in the 150 years from 1776 to 1925, but $190 billion in the ten years from 1960 to 1969. Since the Meiji restoration, Japan has always put education in an important position and the growth rate in "educational capital" has always surpassed the growth rate in "material capital" and "national income." As disclosed by relevant Japanese research reports, the quality of plans for technical innovation raised by workers corresponds with their educational qualifications. With every upgrading of workers' educational standard, the proportion of those suggesting technological reforms increased by an average of 6 percent. It is none other than investment in intelligence that has brought enormous economic returns to these countries.

Japan's economy was on the brink of collapse in the wake of World War II. In 1946, Japan's total output value of industrial production was something like 30.7 percent of the pre-war value. Japan recovered and built its economy on the ruins of the war and, after a rapid development over 20 years (1951-1970), increased its industrial production 15 times, with a yearly average increase of 14.1 percent, leaping to the position of No 2 economic power in the capitalist world. The reason why Japan developed so swiftly lies to the importance they attached to science and education.

Facts have shown that the economic development in every country is influenced and restricted by factors such as its natural conditions, relations of production, political system, ideology, culture, education and science and technology. Under certain conditions, the speed of economic development hinges on the scientific and cultural level of each country.

### Science and Technology Are Needed To Raise People's Ideological Awareness and Build a High Degree of Democracy

A fairly high educational level is required to raise the people's ideological awareness and moral standards. It is hard to imagine that in a scientifically and educationally backward country full of illiterate people, people can rid themselves of ignorance and that a high ideological level and moral integrity can be maintained in society. Of course, we cannot say that a high educational level means high ideological level and moral integrity, for the ideological level and moral integrity of a nation is determined by many complicated factors, not by educational level alone. But it is almost impossible to build up communist consciousness and moral integrity with simple and spontaneous class feeling but without a relatively high scientific and cultural level. The working class cannot produce communist ideology spontaneously but are educated with Marxism by the political party of the proletariat. Such education work will certainly meet with great difficulties if the working class is devoid of a minimum of cultural knowledge.

The 12th CPC Congress report pointed out that it is one of our basic objectives and tasks to build a high degree of socialist democracy. In order to make the broad masses become their own masters, bring into full play their initiative and enthusiasm and develop our system of the people's democratic dictatorship, it is necessary for the people to reach comparatively high levels in science and culture. We have already eliminated the private ownership of the means of production, basically eradicated the basis on which the laboring people were enslaved, and established a democratic socialist system, providing the masses with democratic rights. However, due to the limited level of economic and cultural development, not every one can completely equally enjoy the democratic rights as stipulated by law. On this issue. Lenin once said: We must fully understand what influence the under-developed culture of Russia exerts on the Soviet regime. Although the Soviet regime practices proletarian democracy and sets a good example in this respect, the under-developed culture devalues the Soviet regime and restores the bureaucratic system. In theory, the Soviet regime is participated in by all laborers, but in practice, not all the laborers can join it. It is by no means the law that acts as an obstacle as in the bourgeois era. Instead, our law acts as an impetus. However, law is not enough by itself; we need extensive educational, organizational and cultural work as well as protracted and strenuous efforts. Of course, the situation in China today is quite different from that in the Soviet Union at that time. But the analysis made by Lenin is by no means outdated. For example, we have formulated many policies and laws, but quite a number of people, including some personnel in government organizations, do not understand them well or apply them properly because of their low cultural level. There have occurred many serious problems of people's sense of policies and laws becoming blunted and their failure to execute laws and regulations. Only by raising the cultural and scientific level of the people, can they extensively participate in the management of all economic, cultural and educational affairs of the state and build a high degree of socialist democracy.

## Cultural Construction Must Be Carried Out in the Whole of Society

The important role of science and culture in social development shows that in order to develop a high degree of socialism, it is necessary to carry out scientific and cultural construction on the scale of the whole nation and society and raise the cultural and scientific level of the whole Chinese nation. It is a great and difficult undertaking to build socialism and we need millions of millions of skilled workers, peasants and other laborers with socialist consciousness and modern scientific and cultural knowledge, thousands and thousands of experts with modern scientific technology and cultural knowledge; and hundreds and hundreds of leading cadres with a knowledge of modern economy, modern science and technology and modern business management. At present, the scientific and cultural level of the country, particularly that of the broad masses, is not high as a whole, falling way below the requirements of the construction for modernization. According to statistics compiled by some provinces and municipalities two years ago, of all existing staff and workers, 70 to 80 percent have received education up to junior middle school level and reached a technical level up to grade [illegible] (a system of technical assessment among workers marked by 8 grades, with grade 1 being the minimum and grade 8 the maximum). About [illegible] million young workers in the country have only received primary school education and the scientific and cultural level of the peasants is even lower than that of the workers. If there are no talented people in the field of science and technology, it is impossible to bring into full play the role of advanced equipment and management methods. Some enterprises and units have purchased advanced technical installations but laid them aside for a long time due to the lack of professional technical personnel, thus artificially creating overstocking, spoilage and damage of these installations. In some enterprises and units, although advanced installations are operated, their role cannot be brought into full play because of the operators' low scientific and technical level. China is backward in science and technology on the whole but [illegible] is [illegible]. We have come close to or surpassed the world's advanced level in some fields. But these achievements cannot be turned into [illegible] for quite a long time. What has given rise to such a state of affairs? There are of course many reasons, the most important one being a low scientific and cultural level and the failure to learn advanced technology and science. Some affluent developing countries have introduced and imported into their countries many advanced installations. But, some of the installations [illegible] as a result of cultural construction falling short of the demand in those countries, and the relevant personnel's failure to operate them. [illegible] their experience that we can take [illegible]. In order to raise the scientific and cultural level of the whole nation, it is necessary to [illegible] the relationship between popularization and the upgrading of standards and do a good job in popularizing science and culture. The CPC Central Committee and the State Council made a decision in [illegible] that the whole country [illegible] universalize junior education in various forms by [illegible] and [illegible] developed areas with better educational foundations must strive to [illegible] the spread of schooling. This is a strategic measure to raise the scientific and cultural level of the whole nation and build a high degree of socialist spiritual civilization. Popularizing science and technology is [illegible] raising the standards of science and technology. With [illegible] mastering [illegible] there will [illegible] peasants and other laborers [illegible] a great number of [illegible] in scientific research [illegible] without [illegible] popularization. In this world, no country whose people have a very [illegible] level [illegible].

Of course, when we lay stress on the raising of the scientific and cultural level of the masses, we do not mean, in any sense, that the building of the professional contingent should be neglected. Generally speaking, our professional contingent is not so powerful high standard. It is necessary to bring about swift changes, cultivate new forces, raise professional levels and rapidly establish a mighty professional contingent in science and culture. This contingent must not only take up the task of assaulting fortified positions on the scientific and cultural front, but also take up the task of popularizing scientific and cultural knowledge to the broad masses. The building of the professional contingent is closely linked with the raising of the scientific and cultural level of the millions and millions of masses. The raising of the scientific and cultural level of the broad masses provides a wide and deep basis for the development of the professional contingent and the development of the professional contingent, in turn, guides the work of popularization and the raising of the scientific and cultural level of the masses. We must combine this popularization and raising the scientific and cultural level of the broad masses with the enforcement of the building of the professional contingent and make them stimulate each other and develop together.

## An Important Task of Ideological Work

It is impossible to fulfill the task of raising the scientific and cultural level of the whole nation by merely relying on the scientific, educational and cultural departments or one or two other departments. The CPC committees and government at all levels must place on their agenda as an important matter the building of science and culture, and must not stick to the previous practice in which "efforts are made first in industry, second in agriculture and third in finance and commerce; only spare efforts are made in culture and education," as in some places. Instead, great efforts should be made in scientific and cultural construction as well as in industry, agriculture, finance and commerce. While assessing achievements made by the CPC committees and government at all levels, scientific and cultural construction should be considered as an important part.

In scientific and cultural construction, those engaging in [words indistinct] cultural, [word indistinct] shoulder an extremely important responsibility. Here we must particularly stress the responsibility of those people engaging in ideological and political work. It is self-evident that while carrying out ideological and political work, we must conduct education among the masses in revolutionary ideals, moral integrity and discipline. Meanwhile, there is another important task in ideological and political work, that is, to mobilize and guide the vast number of cadres and masses to enthusiastically and conscientiously study science and technology and vigorously raise their scientific and cultural level. It is the general task of the whole party to realize the four modernizations. Mobilizing the whole party and the people of the whole country to conquer science and culture is a great issue with a bearing on the success or failure of the undertaking of the four modernizations. If we fail to mobilize and guide the millions and millions of masses to set off an upsurge in learning science and culture and to carry out the directive issued by the CPC Central Committee to raise the scientific and cultural level of the whole nation, it means we have not fulfilled the task of ideological and political work.

At present, people engaging in ideological and political work are facing three prominent problems which should be properly resolved. The first one is the underestimation of science and culture. Due to the trammels of "leftist" ideas and small producers' thinking in the past, there existed within our party a very widespread attitude of underestimating science and technology for quite a long time. Even today, some people still harbor this idea to some extent. They take pride in being uneducated, ignorant and incompetent, and even go so far as to harbor the idea that it is possible to build socialism with a high degree of civilization and democracy without science and culture. The second one is discrimination against intellectuals. [words indistinct] connected wrong idea. Some people always consciously or unconsciously put intellectuals in a position opposed to workers and peasants and think intellectuals are not on our own side; [words indistinct], some people think that intellectuals are the targets of "unity, education and reform" and members of the petty-bourgeoisie or bourgeoisie. This is a wrong idea totally contrary to the historical age. The third one is the "leftist" tendency concerning inheriting our cultural heritage. Some people do not critically inherit all excellent cultural heritage but indiscriminately deny all things of feudal and capitalist societies. All these erroneous tendencies and wrong ideas must be gradually corrected through various forms and by conducting patient, thorough and meticulous ideological and political work.

Our great motherland is in a new era of regeneration which, even more than the renaissance era of the bourgeoisie, "needs giants and produces giants." Provided that the party's leadership is strengthened, our ideology is unified, our understanding is raised and the people of the country are fully mobilized to vigorously carry out cultural construction, we will certainly be able to raise to a new level the science and culture of the whole nation and a new flourishing situation in all scientific and academic subjects will certainly appear. The Chinese nation, with its glorious cultural tradition of four thousand years, will certainly stand towering like a giant in the east of the world [as printed] with its new appearance of a high degree of socialist civilization.

# SCIENCE LEADERS DISCUSS ROLE OF SCIENCE, TECHNOLOGY IN SOCIALIST MODERNIZATION

Beijing RENMIN RIBAO in Chinese 5 Oct 82 p 3

[Article: "Contribute to Creating a New Situation in Socialist Modernization; Excerpts from Speeches Given by Members of the China Association for Science and Technology on Studying the Documents of the 12th Party Congress"]

[Text] CONSIDER THE POTENTIAL FOR AGRICULTURAL DEVELOPMENT IN POLICY TERMS Shen Qiyi [3088 0366 4135], Secretary of the China Association for Science and Technology said that the experience of Beijing Agricultural University in several test projects proves that if policy is implemented, the initiative of the peasants is mobilized, and research work in applied technology is coupled with its wide dissemination, the potential for developing agriculture is very great and quadrupled targets could be achieved. For example, Beijing Agricultural University conducted test projects in agriculture, animal husbandry, and processing at a production brigade in Jinghai County, Tianjin. In 1975, this production brigade's gross income was 708,000 yuan. In 1979 it increased to 1.4 million yuan and in 1982 to 1.812 million yuan. By 1985 it plans to reach a per capita annual incomeof 2,043 yuan *US $870), which would bring it up to the level of Xiaoyong, To do a good job in agriculture requires consideration of the following problems. 1. Changing the present system of science education. Education and scientific research are now separated and there are also separate funding channels, as well as separate systems of popularization. Such a situation does ont help make scientific and technical personnel eager to serve production. 2. Resolution of agricultural problems should consider all relevant factors taking account of agriculture, forestry, animal husbandry, sideline production, fisheries and the ecological balance in order to strive for comprehensive development. 3. Under the present situation, in which university students cannot be sent to rural areas, measures should be adopted to get science and technology to the rural areas. We should do a good job of training rural youth so that they master science and technology and assume the task of transforming the objective world.

He Shanwen [6320 0810 2429], Vice President of the Hunan Academy of Agricultural Sciences, said, that the gross value of Hunan's agricultural production is now over 10 billion yuan, and quadrupling it would make it over 40 billion yuan. Closing this gap requires concentrating efforts on diversification and technological reform in agriculture. In view of the present trends in scientific and technological development in agriculture, intensive farming and careful management of the soil and crops in agriculture are fine traditions in line with China's national conditions. The soil management methods of modern agricultural science do not simply involve more plowing and hoeing. The Hunan Academy of Agricultural Sciences recently began research on "rotary tillage for paddy rice" (limited cultivation) and the "no-tillage method for dense planted cotton", and have already achieved encouraging results.

Is the development of diversified farming in the hilly red loam subtropical areas of China in contradiction with maintaining the ecological balance? Can the ecological balance be maintained only by "no farming, no forestry"? This year the Hunan Academy of Agricultural Sciences invited agricultural, forestry, and water conservancy research units to cooperate in some comprehensive test bases set up in the red loam hill areas in central Hunan. They reached an important conclusion, that past red loam improvement and utilization not combined with forestry was "slick and clean farming," forestry involved only "plot afforestation," and water conservancy involved only engineering measures; there was a lack of unified organization and cooperation between them, so they were unable to resolve the problem of disturbance of the ecological balance. Combining agriculture, forestry, and water conservancy, adopting multi-level rational structures, developing diversified farming and maintaining the ecological balance are things which can be considered.

Zeng Dechao [2582 1795 6389], Vice President of the Chinese Agricultural Machinery Society said that agricultural production has a long periodicaty and is restricted by biological processes, environmental conditions, social factors and economic factors, and that its growth rate in most countries is lower than that of industry. To accelerate the rate of development it is necessary to do something about the following three weak links:

1. Processing, storage and transport of agricultural commodities and foods. For example, putting the fibres in agricultural materials (including sideline products and waste products) through special treatment to remove fermentable parts, and then producing alcohol to use as fuel, feeding cattle with protein derived from chemical processing of cereal to lower the cholesterol content of milk and raise its value, cultivating specially effective varieties of bacteria to turn starch into non-crystalline sugar and ferment wheat and rice stalks into fodder, processing and mixing of animal products, development of dairy products, powdering and mixing feeds, use of powdered dried hen manure as feed, dehydration of agricultural products, to prevent spoilage, grading and packaging of vegetables and fruits, and the like. Where the collection of raw materials for processing and retailing of goods are scattered over a broad area and

the agricultural products and food products processing industry as well as the small industries which use local raw materials can only be appropriately distributed through the rural areas, they become a part of agriculture.

2. In the rural areas where short-haul transportation is difficult, simple road surfacing materials might be used to develop transportation. A rational, planned distribution of rural small towns, markets, processing collection and distribution points and a simple highway system could be created. Renewable substitute fuels could be used and the production of tractors which can be used both for farming and for short haul transport could be developed.

3. We should develop rural renewable energy sources. For example, in grasslands and seacoast areas we should use wind power to generate electricity for cold storage to promote the development of livestock raising and fisheries; we should use solar energy in rural production and domestic life; and we should use bioenergy and thermal energy from agricultural wastes to replace motive fuels.

SCIENCE POPULARIZATION WORK SHOULD "FIGHT A REAL FIGHT" Shi Meixin [4258 5019 9515], Deputy Chairman of the Shanghai Association for Science and Technology said, recently we have seen many works of science fiction in some places. I'm not saying that we shouldn't go in for science fiction, but that we should place major emphasis on science popularization which has economic benefits, such as popularizing some applied science and technology among the broad farming masses, for this is something they need urgently. The peasants now have derived benefit from science and technology in areas such as raising chickens, fish, silkworms, and flowers. If the peasants master science and technology they can immediately see the economic benefits and increase their income. Popularizing science should 'fight a real fight' and not 'shadow box.'"

Qiu Weifan [5941 4850 5672], Director of the China Association of Agricultural Science said, "Popular science articles, and especially science fiction, are very hard to write. They should be things with a scientific basis, with the possibility of some day being realized, bringing benefit to mankind in order to get people thinking. If popular science articles do not get the scientific content right, they can be harmful. A few popular science articles and science fiction now are written in a slapdash fashion; this is no good. The China Association of Science and Technology should do some work to help writers and editors improve the quality of science popularization work and assure that it is scientific in nature."

Ye Zhishan [5509 5267 0810], Vice President of the China Science and Technology Popularization and Inventions Association said, "Some people now think that science popularization is easy. This is a misconception. If a writer doesn't have in-depth, broad scientific knowledge and personal practical experience, is not familiar with the aims of the reader, and doesn't have a high intellectual level and ability to express himself in writing, then he cannot write science popularization works."

"Science and technology popularization is a very serious business; it should be responsible to society and the reader and serve the four modernizations. The science fiction published by a few periodicals (including some science popularization periodicals) in the past two years has not had any scientific basis and has basically not been science popularization. Some of their ideological trends are not healthy either, and many parents will not let their own children read such works. Just because it has the word "science" in it, people think it is a science popularization work, and some comrades are blaming us. We have already adopted measures, such as starting science popularization criticism and training science popularization editorial personnel, in order to resolve this problem. At the same time, science fiction (i.e., science fiction which strives to be scientific) is only one type of science popularization work with artistic form; the main effort should be aimed at creating science popularization works which have an abundance of scientific content and are realistic, accurate and inspiring in order to further raise the quality of science popularization works. We call on scientists to devote the time and effort to write some science popularization works for young people and children."

"1. Factories, mines, and science research units should open their doors to young people and children and let them visit to increase their first-hand knowledge."

"2. Science activity centers for young people and children should be opened not only in Beijing, but also in other provinces, cities, and autonomous regions, in order to let all the country's young people and children have the opportunity to participate, absorb scientific knowledge and increase their manual ability."

"3. We hope that the China Association for Science and Technology and relevant scientific associations will establish some service and advisory units for hands-on materials to be supplied to young people, inexpensive kits for model airplanes and ships, and materials and parts for small-scale telescopes and radio receivers."

"4. We need some good, scientific, artistic, interesting television programs on science for young people to really get them thinking."

REALIZE THE VAST OBJECTIVE OF PROVIDING ENERGY SOURCES Tang Dequan [3282 1795 0356], Vice President of the China Coal Association said, "Coal makes up over 90 percent of China's energy resources now. How is our coal problem to be resolved? One way is to increase resources and another is to economize on use."

"As far as increasing sources is concerned, to realize the mission of increasing production it is necessary to vigorously develop mechanized and automated coal mining; this requires close cooperation between machine building departments and other departments. Once the coal is mined, there is the problem of shipping it."

"In the past few years our energy conservation has relied mainly on readjusting the ratio between heavy and light industry; quite a bit of work has been done on saving energy in other areas. By the end of 1985 we will have saved 90 million tons of coal and it will be difficult to economize further. However, our energy use rate is much lower than that of the advanced countries. We still have the capacity to save energy. Saving energy requires technical reform, modernizing equipment which has high energy consumption and designing energy-efficient equipment."

Min Yu [7036 6276] Vice President of the China Petroleum Society said, "We should undertake research on new exploration technology and new petroleum extraction technology. This kind of technology is rather complex and requires cooperation of specialists in polymer chemistry and chemical engineering. Relying on the Ministry of Petroleum Industry is not enough. We hope to organize relevant units of the Academy of Sciences and Qinghua University to do research together."

Li Eding [2621 7725 7844], Director of the China Water Conservancy, Society said, "China's electric power now is mainly fossil-fired and hydroelectric. There is still no nuclear power; it should be developed, of course. Fossil-fired electricity is a secondary energy source since its development relies on developing petroleum and coal. China's water power resources are abundant; from the prespective of investment, hydropower construction is more expensive than fossil-fired electricity, but if we include the expense of coal and petroleum exploitation and shipment, the two are about the same. However, if water is not used it will just flow away. Hydropower has many excellent points and we should accelerate its development. Hydropower construction takes a long time: on a small scale 5 to 6 years, and on a large scale a dozen years; therefore it requires early consideration and investment."

Jiang Shengjie [1203 5110 7132], Vice President of the China Nuclear Society said, "By the end of this century, the gross value of industrial and agricultural production must be quadrupled, but on the basis of present projections, energy resources can only double. What will make up the energy gap? Energy conservation is a long-term policy. Many of the nations in the world think that using nuclear energy to bridge the energy gap in the last part of this century and the first part of the next is an important problem. Over 70 percent of China's water resources are in the southwest and over 60 percent of our coal resources are in north China, while East China, Guangdong and Liaoning urgently need energy; how to get it to them? Nuclear-generated electricity is very urgently needed. In China the importance of nuclear electricity has become known and is being seriously considered. Compared with fossil-fired electricity, nuclear electricity is safe, clean, economical energy. China already has a good foundation and ample nuclear raw materials and should seriously consider using nuclear energy."

TRAIN ALL-ROUND SPECIALISTS Shen Yuan [3088 0337], President, Beijing Aeronautical Engineering College said, "We must quadruple the gross annual industrial and agricultural output value. In the last ten years we have mainly laid a good foundation and accumulated strength. Although the amount of talent trained may not be quadrupled in the next ten years, at least it should double. Take the Beijing Aeronautical Engineering College, for example. Students who graduated in the 1950's and early and middle 1960's have become the technological mainstay in the aviation and aerospace industries. Many of them are the responsible persons in technical areas. They are all over 44 or 45 years of age. On the scale at which we are now enrolling students, all the graduates over the next 20 years will just be enough to replace them and we will not be able to quadruple the number of trained personnel. It takes a long time to educate this "commodity," and if we do not give it early consideration, we will not be ready in time."

Zhang Wenqi [1728 2429 1142], Vice President, China Corrosion Protection Association proposed the following with regard to training people intellectually, morally, and physically:

1. Educational reform should consider the needs of both current and long-range development, and new theories and technology in the field should be reflected in instructional materials.

2. Engineering and science students should study management and should consciously and gradually develop the ability to think and work independently.

3. Study of foreign languages should be strengthened so that students master this tool in order to absorb the advanced technology of foreign countries.

4. Physical education should be emphasized so that when they are young, students will establish not only a good foundation in political ideology and professional knowledge, but also a good health foundation so they can work for several decades.

Shen Hong [3088 7703], President, China Mechanical Engineering Society said, "Managerial work is very important, so in training personnel we should pay attention to the proportion of engineering technical personnel and economic management personnel. A key to quadrupling the annual gross industrial and agricultural output value is to bring the initiative of people into full play. Individual initiative should be increased to equal collective initiative. In our present situation, 1 + 1 equals not 2, but [illegible]. Therefore, training of personnel should also deal with spiritual culture."

Zhang Wei [1728 4850], Deputy Chairman, China Association for Science and Technology, in discussing adoption of a variety of educational methods, said, "The number of students presently enrolled in our institutions of higher learning is about 1.5 percent of the people of that age group. The number of students in secondary school is not larger than the number in college. This "inverted pyramid" is irrational. Adopting a variety of instructional methods is a good way to expand the opportunities for training personnel, but it requires that the entire society do it together. For example, in operating an evening university or non-resident university, apart from school expenses and instructors, there are the problems of commuting to school, noon meals for students and staff, and placement of graduates. This question cannot be properly resolved without mobilizing all the forces of society."

Zhang Wenyu [1728 2429 5940], Vice President, China PHysics Society said, "We should establish a science education research committee or an educational system reform society to study the influence of the examination system on China's education and cadre selection and reform the methods of training personnel. The present method of discovering the encouraging capable persons through the China Association for Science and Technology and the Academy of Sciences scholarly discussions is a good method of selecting and training personnel."

Tan Jiazhen [6151 1367 2823], Vice President, China Genetics Society said, "China's education and socialist modernization are very ill-suited to each other. In agricultural schools in particular there are many problems. Some places divert educational fees to other uses. How can there be agricultural modernization without science and culture? After the party's rural economic policy was implemented and the peasants' standard of living improved, some people felt that study didn't matter, that even if you didn't study you could earn a lot of money. Thus illiteracy is increasing in rural areas and the number of persons from rural areas who enter a university is very few. People from rural areas aren't stupid: many great persons have come from rural areas. It's mainly that we haven't given education in rural areas due attention. All school-age children should go to school. Those who don't should be forced to, and families with economic problems should be given supplements. The nation is in economic straits now, but I think we should consider issuing state bonds to promote education and I believe everyone would be happy to subscribe."

"There are currently two characteristics of science and technology: 1, they are very comprehensive and 2, the cycle is getting shorter and shorter. Our universities have subdivided fields into narrower and narrower specialties. Today you may be able to study a field very thoroughly, but after graduation what do you do when your specialized knowledge is outdated? Universities should create comprehensive universities of many substantive disciplines. Our single-discipline colleges such as colleges of chemical engineering, medicine, agriculture, and now rather remote from each other in terms of discipline. This makes it very hard for the student who has graduated to adapt to the characteristics of technical development in other fields. Our Ministry of Education manages the humanities, physics, and engineering, but not agriculture and medicine. Agricultural schools are managed by the Ministry of Agriculture and the medical schools by the Ministry of Public Health. Each minds its own business and is jealous of its turf. I think training should be primarily general knowledge and basic training with a good foundation; then there can be one specialty and many talents which is good for applied or innovative areas."

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## BUILDING SOCIALISM WITH SCIENCE AND TECHNOLOGY

Beijing RENMIN RIBAO in Chinese 16 Jul 82 p 5

[Article by Liu Chun [0491 2504] and Ming Tinghua [2494 1694 5478]: "Science and Technology are a Magic Weapon for Building Socialism"]

[Text] In the new historical period, in which the focus of work of the entire party and nation has been shifted to socialist modernization construction, with economic construction as the core, we ought to have a magic weapon; this weapon is science and technology. We ought not only to have a deep understanding and adequate regard for the functions which science and technology can perform in the great cause of building socialism, but we must also master them firmly, apply them, and make them manifest their enormous powers.

The enormous effect which science and technology have on the development of the social forces of production can be seen with special clarity in the influences generated by the three successive technological revolutions which have occured since the birth of modern science and technology. "The productive process creates applications for science, and, conversely, science creates the elements of the productvie process, i.e., so-called functions." (Marx) In the 1760's the first technological revolution began, characterized by the widespread application of the steam engine. As "the productive forces created by the bourgeoisie in its less than 100 years of class rule have been more numerous and greater than all of the productive forces created by all preceding epochs," (see 'The Communist Manifesto'), its effect was enormous. In the 1870's the second technological revolution began, characterized by the widespread application of electrical power. It brought about profound revolutionary changes in the realm of production, greatly accelerated the development of the social productive forces and the progress of mankind's material civilization, and brought about a large increase in labor productivity. In the 1940's the third technological revolution began, characterized by the appearance and application of the atomic energy industry, the electronic computer, and space technology. It has brought about an even closer integration of socialized large-scale production and modern science and technology, has effected even more profound changes in the scale of production and in the objects of labor, and the social productive forces and labor productivity have been developed and raised even more and faster. According to statistics, since the

1960's between 60 and 80 percent of the increase in labor productivity in many developed countries has been attained through the application of scientific and technological achievements. One very important reason why Japan has been able to become an economic power in a short period of time is its reliance on a policy of "technology to build the nation", i.e. relying on science and technology. One major reason why some other nations which suffered serious damage during the Second World War were able, within a short period of time after the war, to pass through a period of economic difficulties and effect an economic take-off was reliance on science and technology. Many facts make it apparent that the promotion of the rapid development of the social productive forces by relying on science and technology is not an isolated phenomenon, but a universal law. In the present era, a country's scientific and technological level, and its ability to apply science and technology, increasingly constitute an important indicator for measuring national strength, including both economic and defensive strength. No country, no matter what its national conditions are, or what kind of social system it has, can possibly develop its economy without paying attention to and relying on science and technology. China, in carrying out socialist modernization construction, cannot be an exception. Of course, there are essential differences between the application of science and technology under socialism and under capitalism. As we develop science and technology and apply them to socialist modernization construction, we must learn from the advanced experiences of some other countries. However, we must not copy and imitate them indiscriminately, simply repeating the path which they have taken. We must take national conditions in our own country as the starting point and set out on a path that reflects our nation's characteristics.

China is a developing socialist country. Its basic national conditions are: a large population, little arable land and natural resources relative to the population, backward science and technology and management and administrative standards, and relatively low levels of economic development and of the people's consumption. On this basis, the task of building a powerful, modernized, socialist country, which includes the "arduous struggle of quadrupling China's total industrial and agricultural output in 20 years, and raising the people's consumption to reach a relatively comfortable level", is extremely formidible. We must continue to grasp firmly the four basic principles, but at the same time, we must pay attention to and rely on science and technology. This does not mean just ordinary attention and reliance: we must pay attention to and rely on science and technology more than any other country, genuinely and consciously making it into a sharp weapon for the construction of a powerful, modernized, socialist country. Low technical capabilities and backward tools of production are ultimately related to backward science and technology. In order to bring about a relatively large development of our country's social productive forces within a short time, it is necessary to develop science and technology, to rely on science and technology to open up the intellectual resources of the laborers, to raise the technical abilities of the workers, and to improve the tools of production continuously. The people of China have a high degree of political consciousness, and are famous throughout the world for their diligence and intelligence. If we closely integrate our superior socialist system, our laborers with their high degree of political consciousness, and advanced science and technology, we will undoubtedly be able to create productive forces which no capitalist country will be able to match. There can be no doubt about this.

For example, the population problem is an important problem for our country's modernization. An excessively large population creates great difficulties for raising the people's level of consumption and for solving the employment problem. In order to open up opportunities for employment, it is not only necessary to have a correct guiding policy, it is also necessary to rely on science and technology. One important reason why cities like Changzhou and Shashi have been able to greatly increase industrial output value from year to year, as well as finding solutions to the employment problem, is that they have given free rein to the functions of science and technology. One Western European country, by developing a new branch of applied science and technology, subsequently acquired a new group of industries, thus solving the employment problems of several hundreds of thousands of persons at one stroke. The idea that because our country's population is great, the development of science and technology, and the raising of labor productivity will necessarily render the employment problem even more difficult to solve, is in correct. In fact, the application of science and technology can not only greatly raise the productive efficiency of labor and save manpower, it can also continuously extend the realm of production, and open up new trades, thereby creating even more social wealth and providing even more opportunities for employment.

Furthermore, China has a shortage of arable land, which greatly limits the output of grain and other agricultural products. In order to develop the vast potential stored up in the rural areas, to fully utilize every inch of land, and to greatly raise the quantitative and qualitative output of agricultural products, it is necessary, while continuing to perfect the production responsibility system, to arm agriculture step-by-step with the weapons of science and technology. Only this will produce great results. Only a close integration of advanced science and technology with correct policy and with our national tradition of intensive and meticulous farming, can enable our country's agricultural modernization to develop day by day and month by month, and enable the manpower resources of the vast rural areas to manifest an ever increasing effectiveness.

Furthermore, although China's industrial development has already attained a considerable scale has a fair foundation, the economic results are still very low. At present, a salient question is how to tap the considerable hidden potential which actually exists. The large-scale installations which our country has at present still have relatively large productive capacities which we have not been able to bring into play. Only small improvements are necessary in quite a few installations to enable them to be even more effective. Only small improvements are necessary in quite a few products to greatly increase their competitive strength on international markets. At present the quality index for the important industrial products of the nation's key enterprises is still 43 percent, while the raw material consumption index is still [illegible] percent. The historical high levels have not been restored. If we can apply the powers of science and technology to tap potential and reconstruct presently existing enterprises, we can certainly create productive forces which are far greater than those existing at present. After technical improvements were made at 6 oil refineries in the Northeast, the newly added productive capacity was equal to that of 4 newly built oil refineries, but the capital employed was less than 1/3 of the capital required to build 4 new oil refineries. Furthermore, there were savings in time, equipment, manpower, and the like. Also in this region, after technical innovations and improvements were made at a certain factory, 11 automatic machining lines and 21 assembly lines were set up. This made it possible to automate the production of more than 10 components, and to greatly increase productive capacity. Previously, 1 worker could only produce 1 machine per year; now, 1 worker can produce 10 machines per year. Product quality has been stabilized at or above the highest level. All of these examples go to show that in carrying out expanded reproduction of the intensive type, the magic weapon of science and technology can perform extraordinarily important functions.

To sum up, science and technology have already become a decisive element for [illegible] modernization and for energetically developing the social forces of production. If only we can firmly grasp this magic weapon, [illegible] closely on it, and thoroughly transform the vicious circle in which science and technology is neglected because the economy isn't developing, while the economy doesn't develop because science and technology are neglected, then our country's modernization construction will certainly achieve most heartening results.

An unwavering and firm treatment of science and technology as a magic weapon, and a clear understanding of the truth that there can be no building of a powerful, modernized, socialist country without highly developed science and technology, are necessary conclusions of our summation of the lessons of many years of past experience, and our implementation of the party's guiding policy line since the Third Plenum of the [illegible] Central Committee. Ever since the founding of the People's Republic, the Central Committee has paved close attention to science and technology. In [illegible], Comrade Zhou Enlai, representing the Central Committee, emphatically pointed out in a report to a meeting concerned with the problems of intellectuals: "In the socialist era, more than in any [illegible] era, it is necessary to thoroughly raise the level of [illegible], and to thoroughly develop science and make use of [illegible]" and "science is a decisive element which affects [illegible] our culture." In [illegible], Comrade Zhou Enlai further pointed out: "The key to realizing the [illegible] lies in the modernization of science and technology." [illegible] Comrade Mao Zedong emphatically pointed out that [illegible] science and technology [illegible]. In the past, we carried out [illegible] the superstructure, a revolution in the relations of production. [illegible] if we do not go all out for science and technology there will be [illegible] the forces of production." In addition to all [illegible] concrete measures for the development of science and technology. The successes attained in science and technology have made great contributions to economic construction and construction for national defense. Nevertheless, because of "left" errors existing in the guiding ideology of economic construction work, there are also many evils and problems in organizational systems, policies, and the like, so that it has not been possible to conscientiously and thoroughly implement many of our party's important ideas and measures concerning the development of science and technology, and the functions of science and technology have been seriously neglected. The wrecking activities of Lin Biao and the "gang of four" during the 10 years of domestic disorder were especially responsible for a widening in the gap between China's science and technology and that of the economically advanced countries. Since the Third Plenum of the 11th Central Committee, the termination of disorder and setting up of things to right in the guiding ideology, the shift in the focus of the work of the entire party and nation, and the fundamental change in the guiding principles for economic construction, have enabled our country's economic construction to begin to get on a new road of healthy development which is suited to our country's national conditions. Along with this, scientific and technical work is more and more becoming the important order of the day for the work of the entire party and nation. In theory and in guiding ideology, the series of important principles and conclusions which our party has reiterated and expounded such as: "Science and technology is a force of production" "Modernization of science and technology is the key to the four modernizations" "Without science education it is impossible to build socialism: "In developing the economy, stick to the policy and rely on science" and so on, are now understood and accepted by more and more of the cadres and masses, and are being turned into conscious action. At the same time, in economic construction there have appeared a series of profound changes which have been more and more dependent on science and technology, as the capacity of economic construction itself to absorb science and technology increases constantly.

Science and technology do not have a class character. However, under different social systems, not only is the aim of the application of science and technolgoy fundamentally different, but their development has a different destiny. Under the capitalist system, the contradiction between the developmental tendency of modern science and technology towards ever increasing socialization, on the one hand and the capitslit private ownership system and the anarchic conditios of production on the other is becoming sharper every day. Under socialism, the socialist relations of production and the developmental tendency of modern science and technology towards socialization are fundamentally in harmony. Socialism is able to allow science and technology to develop the forces of production with a speed which capitalism cannot match.

China's superior socialist system, and diligent and intelligent people, under the strong leadership of the CPC, and, in addition, with a correct guiding policy of developing the economy and science and technology formulated on the basis of summarized experience, enables us to have profound confidence that science and technology will certainly play important roles in socialist China, and will in a short time, transform the present relatively backward state and move us into the world's front ranks.

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## INTERVIEW WITH YANG ZHENNING ON PRC SCIENCE

HK240435 Hong Kong TA KUNG PAO in Chinese 23 Feb 83 p 1

[Report: "Yang Zhenning [2254 2182 1380] Talks to This Paper on State of Science and Technology in China"]

[Text] According to a report by Chong Ming, correspondent of this paper, Professor Yang Zhenning, honorary professor of the Hong Kong Chinese University, visited Beijing during the Chinese spring festival. During his several-day visit to China, he met with Premier Zhao Ziyang and scientific and technological circles. Yang Zhenning was very pleased to see that China has found out a correct new way for her scientific and technological policy, that is, scientific and technological research should be geared to the needs of the national economy and serve production.

The new orientation of China's scientific and technological development has left a deep impression on Professor Yang. Those familiar with him know that as a highly authoritative physicist, he has stuck to the point for years that physicists in China should not develop high-energy physics but should adopt a practical and realistic method. He has put forward this viewpoint many times to the Chinese leaders and scientific and technological circles.

In December 1981, in a letter to Vice Premier Fang Yi, a leading cadre of the Chinese Academy of Science at that time, he fully expounded the above viewpoint and stressed that science and technology in China should be geared to the needs of industrial and agricultural production. He pointed out that China had scored some famous results in scientific research in the past but actually, they could not bring any results to production and they could not bring direct results to the growth of production and the improvement to the people's living standards. This is not suited to the present situation in China.

At the same time, a copy of the letter was also forwarded to Premier Zhao Ziyang who agreed with the letter and then passed it to Vice Premier Deng Xiaoping. Then the letter was delivered to the academy of sciences for discussion.

During the interview, Premier Zhao introduced to him the new scientific and technological policy which is geared to the needs of the national economy and production last year.

Referring to scientific research meeting the needs of the national economy, Premier Zhao had made this point clear in his opening speech at the national prize-giving meeting for scientific and technical inventions.

Yang Zhenning said yesterday that he had gone through word by word the opeing speech of Premier Zhao published in the press when he was in the United States. Professor Yang was so happy with the national meeting for this reason. He did everything possible before to encourage the Chinese physicists to develop coagulation research. Coagulation physics is closely linked with the production of transistors, calculations and optical fiber communications.

Professor Yang considers that the new scientific and technological policy of China is generated by the sustained pragmatic policy pursued by Deng Xiaoping. In the late 1970's, China worked out a complete plan for its scientific and technological development but some of it was unrealistic and aimed too high. Consequently, China suffered setbacks in its scientific research. Fortunately, they corrected the mistake in a short time. Finally, scientific research in China is marching along a path based on facts.

Will this new policy exert influence on China's future? The influence will be very important, according to Profressor Yang, who previously had reservations about the target set by China to quadruple her total output value in industry and agriculture by the end of the century, because it would be impossible for China to have an annual increase of 7 percent in output value for the next 17 years according to its present production conditions. However, today, China has for the first time geared its scientific research to the needs of the national economy. This is a mighty force for promoting production growth. By the end of the century, if the industrial, agricultural and scientific and technological forces in China have reached a certain level, then it will not be a question of quadrupling output value; China's economy will develop by leaps and bounds.

Being concerned with China and her scientific and technological development, Yang Zhenning, a foresign scientist of Chinese origin, expressed his full support for the present scientific and technological policy of China. China's science and technology which are geared to the needs of national economic development will make important contributions to its modernizations.

CSO: 4008/58

## U.S. PROFESSOR GIVES VIEWS ON SCIENCE POLICY

Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 6, 16 Jun 82 p 32

[Article: "Professor Li Cheng-tao Gives Opinions and Suggestions Regarding Modernization of China's Science and Technology"]

[Text] On 13-27 December of last year [1981], Professor Li Cheng-tao visited China in connection with the construction of an electron-positron colliding-beam storage ring and with the selection by examination of graduate students to study in the United States. In addition to discussions connected with his work, he also expressed some opinions and suggestions regarding China's scientific modernization.

### Training Top Scientists

Professor Li said that the training of scientific and technical personnel, particularly top personnel, is different from the training of others. Those to be trained should have three qualifications: youth, quality, and high-quality university or graduate school training during their youth. Like the Chinese women's volleyball team, as soon as they join the ranks they should immediately begin training, and the training work should be rapid and intense and should be followed by "taking the field"; there should be no interruptions. Only in this way can the young people's youthful vigor be maintained so that they can create what others cannot. The most important thing is nurturing young people's vigor and helping them maintain it. He had heard that in China the rule is that when university students graduate they must work for a full 2 years before they can attend graduate school or go abroad for study; this might be suitable in most cases, but it should be reviewed in a few cases.

Prof Li said that people being trained as top scientists and engineers should be given relatively great freedom; they should not be restricted too rigidly or held in any one direction. Their interests and tastes should be allowed to develop, while at the same time, they should be taught how to carry on path-breaking work. He said that when engaged in work, the scientist should take his own path and should not have to spend a great deal of effort on what other people have already done; all that is required is that he know what other people are doing and where the weak points are. This is because as a rule many people are engaged in any given research a topic, and if they suddenly reach a plateau, they may bog down there. At this point it is necessary to focus on other people's problems, open up new paths, and create a new situation.

In discussion the use of study abroad to train top scientists and engineers, Prof Li said that China should have permanent scientists and professors to maintain ties with them, to be concerned about them and to relate their studies to domestic developments.

He also said that the scientific and technical colleges and graduate schools have a very good reputation abroad and their influence is increasing, so that they must resolve to do well.

### International Academic Exchange

According to Prof Li, international academic exchange is extremely important for developing science and technology. He suggested that there be more visiting lectureships named after eminent Chinese scientists, to which well-known persons with good achievements should be invited. This would make it possible to absorb advanced international experience and specialized thought in timely fashion and would expand our country's international prestige.

### Creating an Atmosphere of Respect for Scientists

Prof Li said that noted scientists are highly respected in the United States, and their pictures are displayed in many conspicuous locations. For example, pictures of many scientists are hung inside the entrance to the Massachusetts Institute of Technology, including that of the Chinese scientist Ge Hong of the Jin Dynasty. But in China, this is very uncommon. We should gradually establish an atmosphere of respect for scientists and for science.

### Publicizing Chinese Science and Technology

Professor Li repeatedly emphasized that China's publicizing of its science and technology has often made it a laughingstock, and some achievements are have been publicized in the papers without proper review, which not only has a bad effect inside China, but does a good deal of harm abroad. He suggested that China should have laws regarding this matter.

### Reforming Scientific and Technical Management

According to Professor Li, the equipment and buildings of some research institutes are first-rate or even super-first-rate by world standards, and there are some high-quality research bodies; but there are great problems in scientific research management, so that people and equipment cannot produce results, and even if the state increases its investments, it is unlikely to achieve the desired results. He said that the associated plants of some research institutes do not appear to be intended to serve science, and if the researchers want something done, they have to do it themselves. In addition, administrative procedures are very complicated. These circumstances should rapidly be corrected. In the future, administrative leaders, associated plants of research institutes, and all other management departments should firmly take an attitude of serving science. We should boldly use the top young scientists and engineers who are a backbone contingent, and the administrative support system should give them energetic support and coordination. Older scientists in poor health should be retired from the front lines of research, for their presence does not help progress.

8480
CSO: 4008/198

## ACADEMY OF SCIENCES HELPS SOLVE CRUCIAL PROBLEMS

Beijing RENMIN RIBAO in Chinese 5 Sep 82 p 4

[Article: "Academy of Sciences Vigorously Organizes Forces To Solve Crucial Scientific and Technical Problems"]

[Text] Reporters Wang Yougong [3769 0645 1872] and Chen Zujia [7115 4371 3946] report: In their recent interviews, Vice President Yan Dongsheng [0917 2639 3932] and Adviser Gu Yu [6253 7183] of the Chinese Academy of Sciences stated that participation in the solution of crucial scientific and technical problems in the major projects of the national economy must be placed in an extremely important position in the work of the academy today. The two responsible comrades stated that the state has assigned three main tasks to the academy, viz., rendering service in the solution of major, comprehensive and crucial scientific and technical problems in national construction; conducting basic research; accumulating data of natural science. On organizing forces to solve the problems, they said that the academy, ever since its founding, has always placed this task in an important position. By means of the practice of scientific research, we have trained an able and competent scientific research contingent of many fields of learning and accumulated considerable scientific and technical knowledge and methods of research. Therefore, the academy must and can organize greater forces to participate in the solution of major scientific and technical problems in the national economy.

On the progress of the work of organizing forces, they said that efforts in the following aspects have been made in the past 6 months or more:

1. Strengthening organization and leadership. It has been defined that the vice president in charge of day-to-day affairs and a deputy secretary general are to take charge of organization and leadership. The academy also called a meeting on solving the crucial problems, and the various departments, committees and institutes proposed and gradually epitomized [illegible] problems under 43 subjects of study, including agriculture, energy, environmental protection, soil improvement, land reclamation, new technology, new material, computer science, population and scientific management. Thus, the major research projects of our academy are fairly centralized and systematized.

2. Strengthening the Vertical and Horizontal Contacts Among the Departments. We made reports many times to the State Planning, State [illegible] and State Scientific and Technological Commissions and coordinated the subjects proposed by us with the projects considered by the state as crucial. Meanwhile, we invited the representatives of many departments to speak on the economic development and propose subjects. In chemistry, for instance, we asked the petroleum, chemical industrial, light industrial and metallurgical departments to make reports. Thereafter, investigation groups were organized to study catalysis, chemical industry, macromolecule and fine organic synthesis. After 2 months of investigation, some of the subjects were decided on. In regard to the existing subjects of the various institutes, we followed the principle of tackling the major strategic problems, organizing multiple-field and large-unit operation and solving the crucial problems of the state and made suitable adjustments. Today, the academy has decided on 37 subjects of study in its crucial research plan.

3. Going Deep into Production, Investigating and Studying and Determining the Subjects. We sent two large investigation and study groups, led by [illegible] leading comrades and participated by the scientific and research personnel [illegible] to the first line of production to search for subjects. One went to Shanxi to investigate the development of its energy bases; the other went to Hebei, Shandong and Henan to investigate the comprehensive administration and rational development of the Huang-Huai-Hai plain. The investigations and studies not only helped us to decide on many concrete subjects, but also enlightened our minds, making everyone feel concretely and deeply that the development of the national economy is inseparable from science and technology and that science and technology must be included in economic planning before they can produce a benefit.

4. [illegible] Full Play to the Roles of Scientific and Technical Workers, Especially [illegible] Members and Experienced Scientists. The enthusiasm of the scientific workers for solving crucial problems is very high. [illegible] chemical industrial section of the Chemistry Department [illegible] members of the department. [illegible] their enthusiasm, the [illegible] show a high sense of responsibility toward [illegible] of the state which we fully support.

[illegible] to solve the crucial scientific and technical [illegible] four stages, i.e., investigation and study, [illegible], evaluation and demonstration [illegible], and organization [illegible]. Currently, we have progressed to the second stage. It is anticipated that the work of evaluation and demonstration will be completed [illegible] of the year, and we will organize forces to [illegible] the crucial scientific and technical problems. [illegible] the academy said that there are several issues requiring further solution. To organize forces, strong leadership and measures are needed and the conditions must be present. Solving the crucial problems calls for the close cooperation among manifold branches and fields of learning. We must further break down the departmental boundaries, strengthen ideological-political work and bring it into professional work.

6080
CSO: 4008/13

## DEVELOPMENT OF TECHNOLOGICAL SCIENCES URGED

[illegible] Beijing RENMIN RIBAO in Chinese [illegible] Aug 82 p [illegible]

[Article by [illegible] [illegible]: "Science and Technology Must Render Better Service to Economic Construction"]

[Text] The modernization of science and technology is a very important aspect of the four modernizations construction program. The question of how to develop China's scientific and technological programs is a strategic one and this article [illegible] to give [illegible] opinions and knowledge of this question.

Economic Construction [illegible] the Development of China's Science and Technology [illegible]

In the government work report at the fourth session of the Fifth NPC, Premier [illegible] set out the basic policies for the development of China's science and technology with great clarity. He pointed out that there were many different [illegible] science and technology and that each one should receive attention [illegible] research should not be relaxed, but despite this the [illegible] the development of scientific and technological [illegible] render better service to economic construction. The task [illegible] is how to [illegible] and improve the role played by science and technology so that [illegible] productive forces and thereby a giant [illegible] economic development.

[illegible] made for the [illegible] development of science and [illegible] society, and suits China's [illegible] with the laws of [illegible] development. Not only [illegible] significance for the development of China's scientific and [illegible], at the same time it [illegible] China's [illegible] modernization construction program, and it [illegible] national economy and [illegible]

[illegible] China's [illegible], we must increase [illegible]

First, while accurate and sharp technology and some theoretical research have proved themselves extremely successful and fruitful, production technology has fallen behind to an alarming extent.

China has [illegible] million people working in science and technology, with [illegible],000 experts in scientific and technological research. While China has achieved relative success in theoretical research and accurate technology and has already come into line with the world's advanced countries, we remain still very far behind in terms of production technology. Within the national economy the influence of production technology which has been applied in great depth and very extensively, has still, for a long period of time, not improved in any way and thus widespread high consumption, high production costs, general inefficiency and low quality production still exist.

Second, as a result of the blind pursuit of "precision and advanced technology" and "catching up and overtaking," the emphasis of scientific research has been laid too heavily upon accurate technology and some of the pure sciences, thereby ignoring research into production technology. Thus while we have achieved some results in the research of "precision and advanced technology," in the long term such results remain at the stage of samples, exhibits or gifts, while others remain filed in the filing cabinet and cannot be developed into products and actual commodities. The process of transforming scientific research results into production development is extremely slow, the transition period being very long.

Third, individual studies produce results while synthesized efforts do not. Many individual scientific and theoretical studies have made considerable breakthroughs and achieved [illegible] results, while synthesized or joint technology and the popularization of its applications often come up against obstacles. For example, scientific research into the capacity, speed and other aspects of computers has produced definite results, but the extent of popularization has been very limited. Likewise, development has fallen short in areas of production technology such as the design, processing and production of large-scale and super large-scale integrated circuits or automatic printing. Some results have been done only on a theoretical basis or perhaps in the laboratory, [illegible] [illegible], but because of fundamental weaknesses in production technology and the underdevelopment of the production of basic spare parts and accessories, it has been impossible to create a composite of synthesized production [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] production [illegible].

Fourth, although in recent years the importance of [illegible] has been recognized, [illegible] has not [illegible] been realized. This has resulted in inappropriate [illegible] [illegible] [illegible], China has suffered [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] equipment, [illegible] [illegible] [illegible] [illegible]. [illegible] assumed that we only [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

[illegible] appreciate that under the guidance of [illegible] [illegible] problems are being [illegible] and [illegible] scientific [illegible] becoming more and more active and vigorous.

[illegible] Sciences within the Natural Sciences and the [illegible]

[illegible] and technology has resulted in a much more detailed [illegible] various branches and, at the same time, more and more [illegible]. Each area of research becomes more and more specialized and narrow. Likewise, as the extent of man's knowledge deepens it becomes less [illegible] for one person to come to understand every aspect of knowledge [illegible] consequences that the scale of scientific research [illegible]. Thus if one wants to improve the efficiency of scientific [illegible] in the sky.

[illegible] inventor was often both a scientist and a [illegible] example. Today, the great speed in [illegible] and technology and the constant widening and deepening [illegible] made the existence of such men and women very [illegible] today it is basically impossible for one person, within [illegible] significant achievements in the now numerous fields [illegible]. New scientific developments or innovations now require [illegible] cooperation of many people in many disciplines. It is [illegible] or relying solely on the skills and [illegible]

[illegible] three [illegible] of labor, namely the [illegible] interdisciplinary [illegible] engineering.

[illegible] sciences [illegible]

[illegible]

The secondary natural sciences (as well as engineering or applied science) may be linked to a country's development in terms of agriculture, advancements in all areas of industrial technology, the raising of people's living standards and quality of health as well as directly influencing the ups and downs of the national economy and the strengths of weaknesses in the country's capacity for national defense.

Thus one may say that the achievements of the primary natural sciences directly serve mankind, while the achievements of the secondary natural sciences help develop the national economy of our country, people's standards of living and the construction of national defense. The primary natural sciences form the theoretical basis for the secondary natural sciences, which, in turn, make use of the achievements of the primary natural sciences to develop the economy, while at the same time developing new demands of the primary natural sciences and therefore acting as a catalyst for further development and progress in the primary natural sciences. The relation between the two is extremely intimate and neither one is dispensable. In general, primary natural scientists are all scholars or professors, such as mathematicians, physicists, astronomers, chemists and biologists while secondary natural scientists tend to be engineers, agriculturalists or doctors in their own specialized fields. While there exists this close relationship between the two, there is still a clear division of work between them and one cannot ask a biologist to cure a complex disease as one could not ask a mathematician or physicist to go and design and procure a super large-scale integrated circuit, an airplane or a submarine. Of course such a division of labor has been common knowledge for a long time.

Since liberation we have followed a very winding road as far as the problem of correctly appraising the positions of primary and secondary sciences are concerned. In the last 30 years the main emphasis of China's scientific research has been on the primary natural sciences, paying relatively little, if any, attention to the development of the secondary natural sciences. This may be illustrated by the following few facts.

In the 1950's, the establishment of the Chinese Academy of Sciences (CAS, major importance to the primary natural sciences but today has still not seen the foundation or development of a technological sciences institute for the secondary natural sciences. Some departments within industry have set up research institutes on a small scale but difficulties are considerable. But, in the main "headquarters for China's science and technology", within the CAS, 90 percent are primary natural scientists, a number several tens of times larger than the number of secondary natural scientists, and only a very minimal number [illegible] in engineering technology section. In recent years, all the model scientists established and popularized by the press have been scientists of the primary natural sciences, such as mathematicians or biologists. Of course, such scientists are extremely important but the scientists who have [illegible] the development of China's engineering technology almost receive nearly no public attention. [illegible] awards and prizes for scientific achievements only [illegible] [illegible] research achievements and still put more emphasis on the evaluations of foreigners, thereby ignoring the actual applications of achievements and their effects on the economy as well as the value and capacity of such achievements to solve realistic problems. Furthermore, workers in the engineering departments of science and technology do not in general receive as much wages as general workers of the same age.

For these reasons most young people in China are now working hard towards areas of study such as mathematics and theoretical physics, and if one looks at the cross section of the brightest students who sit university examinations, the majority are sitting subjects such as mathematics and physics, while the number sitting subjects such as agronomy, medicine and engineering technology is relatively small. This kind of trend presents certain dangers for China for, while China naturally needs to develop studies in mathematics and theoretical physics, it is of far greater importance, under the present problems of manpower and material resources, to develop the technological sciences to allow the country's economy to flourish and make the population richer. It is far more pressing to use the country's manpower and material resources to develop the potential of China's economy, a far more directly urgent program, thereby helping to solve the pressing problems facing the people today.

A great deal of experience and knowledge has been amassed in the last 100 years in the development of science and technology overseas, and some of it is well worth our making use of and drawing on. For example, having experienced an industrial revolution, England has relatively good industrial foundations. It was in England that Watt invented the steam engine and the development of the weaving and textile industry also began in England. In scientific terms, England is a fairly well developed country and it may boast more Nobel Prize winners than any other country in the world. The Cavendish Physics Laboratory at Cambridge University alone have produced 26 Nobel Prize winners. Most of the members of the Royal Academy in Britain are scientists of the primary natural sciences, enjoying renown throughout the world. Today, however, the country's strength is diminishing and on international markets, England's products lack [illegible], the economy is weak and unemployment high, making England today [illegible] poorest nation in the European Economic Community. Having realized [illegible], England is now trying hard to rectify the situation.

[illegible] similar situation, it has a good industrial foundation but attention was focused too much on culture and not sufficiently on technology and as emphasis [illegible] the fundamental sciences, the technological sciences became [illegible]. While France has seen considerable success in the [illegible] natural sciences, the country's national strength has continually weakened [illegible] century and France now lies behind West Germany.

[illegible] World War II, both West Germany and Japan have successfully [illegible] world's most powerful [illegible] countries on the ruins [illegible] the development and [illegible] the secondary natural sciences. [illegible] countries importing [illegible] know-how, then intensifying research and assimilation, they began to improve and develop the technology so that developments within their own countries soon overtook those of other countries. For example, by following a principle of putting greatest emphasis on the secondary natural sciences, Japan's shipbuilding and car-manufacturing industries as well as its watches, cameras, televisions and electronic calculators have placed the country in a position of strength which now threatens Europe and the United States. Japan has not invested much effort in the primary natural sciences and it is not worth evaluating the number of Nobel Prize winners it has. The number of students in Japan in secondary school and at university who are studying technology is enormous, [illegible] of 20 percent of the entire university student population, but they are not all aspiring to be university professors by any means, even though it must be admitted that in Japan to be a university teacher is extremely prestigious. Rather, it is the good prospects offered by the giant corporations which attract the majority of the most talented Japanese students. And there are other factors and conditions which influence the general movement of young talent towards the companies. These are all important factors which have turned Japan into an economically advanced and technologically highly developed, rich nation.

The period of World War II also saw both the United States and the Soviet Union make speedy developments in the technological sciences. The Soviet Union's successful launching of a satellite into space in the 1950's caused the United States to panic, creating the misconception that the launching of a man-made satellite by the Soviet Union indicated an emphasis on the fundamental sciences. The result was that the fundamental sciences received a great deal of attention and promotion in the United States, with disastrous results. By the 1970's, pressure from Congress resulted in an institute of engineering sciences being set up to try and create a balance between technological sciences and the fundamental sciences. In 1980 a bill was passed in the U.S. Congress to set up an engineering foundation. Congress felt that the constant emphasis on the fundamental sciences by the science foundation had seriously damaged industry and that there was now a need to balance things out. The result of this was that the science foundation, with some anticipation, immediately expressed the need to return to the technological sciences and change its previous direction. The most recent president of the science academy was in fact a specialist in the technological sciences.

Our past experience shows the extreme importance of the [illegible] sciences towards [illegible] development. From a development [illegible] it is [illegible] that the [illegible] will always be of first importance. [illegible] the [illegible] will always be the [illegible] areas [illegible] economic development. Hence [illegible] situation in the country [illegible] and the society. And [illegible] efforts [illegible].

## How May the Development of China's Technological [illegible] be Speeded [illegible]

As far as technological knowledge and work are concerned, it is important that we concentrate on solving the following few problems.

First, we must fully motivate those working in science and technology. The 6 million-odd workers in the fields of science and technology in China form the basic strength behind the development of China's technological sciences. We must promote a morality in these workers of making great contributions to the fatherland. We must promote the great qualities of these voluntary, nameless heroes in advancing the cause of socialism and fighting against selfish departmentalism and individualism. For it must be remembered that the vast majority of today's achievements in scientific and technological research are the result of collective labor. Thus we must encourage cooperation and camaraderie in work. We must allow each individual to earnestly develop his or her potential within the framework of collective labor, permitting suitable "collective environment" and cultivating the committed spirit of "selflessness." We must not overemphasize the role of the individual but must encourage everyone to incorporate their knowledge and skills into the great cause of science and technology. We must establish a realistic approach and take care to prevent and overcome nonintegrated methodology.

Second, it is vital that we improve the training of scientific and technological personnel. According to statistics released by the United States Science Foundation, the productivity of the work force of every country in the world is in direct proportion to the number of people engaged in science and technology. Since Japan has the highest proportion of engineers, it follows that Japan also has the highest productivity. After realizing this point, the United States immediately began to improve its training of scientific and technological personnel. Japan has a higher proportion of advanced industrial institutes and engineering universities within its university system than anywhere else; in addition, the cultural standards of the workers are the highest. Hence, raising the [illegible] technicians [illegible] and this was one of Japan's secrets to success in raising the [illegible] of its production. [illegible] university graduates [illegible] second [illegible]. The [illegible] in the development of [illegible] set up more [illegible] universities at the moment, [illegible] very few [illegible] [illegible] the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

[illegible]

seen a serious drain to foreign countries of qualified scientists and technologists from developing countries. From the end of the 1960's to the end of the 1970's, the United States and Canada admitted around 250,000 immigrants, comprising three quarters of the qualified graduates of less developed countries. In this 10-year period, the drain on developing countries included 100,000 people trained in specialized fields of technology. The last 30 years have seen over half of Latin America's engineers emigrating to the United States. Of South East Asia's highly trained specialists in extreme heat refinement technology, between 35 and 40 percent have emigrated to the United States. Such an immigration of highly talented technical workers into advanced country can save the country up to $65 billion in training costs. And of course the advantages to be gained from their exploitation and general consumption within society is immeasurable. Thus the "brain drain" and large-scale importation of equipment from abroad are both negative phenomena, since they are both ruinous in financial terms. This problem should be taken very seriously by everyone.

Fourth, we must elevate the position of the technological sciences, and below are several suggestions for ways of achieving this.

1) To set up a China Institute of Technology, to stand side by side with the research institute for the natural sciences (now the CAS) and the research institute for the social sciences.

2) To set up a China Engineering Association along with the present Association of Chinese Scientists.

3) In evaluations for academic positions, promotion and the presentation of awards, the importance of the technological sciences should be examined, for we must fully recognize the contributions made to the national economy by technological achievements. Furthermore one should not only value theoretical standards and aptitude in foreign languages, but should set up technological scientists as standard models and not only make paragons of experts in the fundamental sciences. There should be guaranteed funds to support the development of the technological sciences as well as greater interest in and attention paid to progress reports on scientific and technological developments and the exchange of ideas of a technological nature.

Fifth, it is very hard to propagate the need for [illegible] in the [illegible] trend of [illegible] and [illegible]. [illegible] the technological sciences [illegible] and the people. [illegible] be [illegible] up and the [illegible] the people's [illegible] be raised. [illegible], the trend of our graduates [illegible] practical experience [illegible] and not immediately [illegible].

# KEY USES OF SCIENCE AND TECHNOLOGY IN DEVELOPING ECONOMY LISTED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No 4, Oct 82 pp 20-23

[Article by Tian Zhengyi [3944 2973 5030] of the Huainan City Science Committee: "Science and Technology Are Key Links in Promoting Economic Development"]

[Text] The fact that science and technology, as a productive force in society, can promote social and economic development has been acknowledged. But how science and technology can most effectively promote social and economic development is a problem that urgently needs to be studied and solved. For this reason, we must fully understand both sides of the problem: our nation's actual capabilities in science and technology and the actual condition of our economic development. We must proceed from these two actual conditions before we can grasp the key link of science and technology to develop their greatest economic benefits.

When studying our nation's policy for science and technology and exploring how science and technology can develop their greatest economic benefits, we must fully consider the problems and difficulties encountered in our nation's economic development, and we must also consider the changes that have occurred in the development of our nation's economy at present so that the strategy to develop science and technology and the strategy to develop the economy can be coordinated. Our nation's strategy for economic development is still being explored, but it has already produced the following changes: 1. It has gradually reduced the rate of accumulation and changed the traditional strategy of "high accumulation and low consumption" in seeking to establish a good economic cycle. 2. The key points in development has been shifted from heavy industry to agriculture and light industry. 3. It has gradually changed the practice of expanding reproduction based mainly on extension to the practice of expanding reproduction based mainly on intension. To enable science and technology to effectively serve economic construction, we must fully consider these changes.

After fully considering the difficulties and problems encountered in economic development, and the changes in the strategy for economic development, how should science and technology effectively promote economic development? What are the key links?

## I. Science and Technology Should Help Economic Development Eliminate Difficulties and Should Help the Weak Links

The national economy is a huge system. In its course of development, we will unavoidably encounter difficulties in certain links. If the difficulties cannot be solved, these links will become the "bottlenecks" in economic development and hinder the high speed and stable growth of the economy. Conversely, after these difficulties have been overcome, and as soon as the bottleneck is widened, the national economy will jump by a certain degree and develop on a new level. Therefore, the weak links in economic development--"the bottlenecks" are also the turning points for economic progress.

Obviously, for science and technology to effectively promote economic development, we should place our own key efforts on the weak links in economic development to eliminate difficulties and to open up new roads for economic development. When determining the direction of scientific and technological development and establishing the principles of selecting the best subjects, this spirit must be fully manifested. Concretely speaking, we must focus on and study new technologies that develop and utilize energy sources and conserve energy, the technology to comprehensively utilize resources, low consumption technology for various types of materials, new materials technology and prospecting, mining and ore selecting technologies. Related basic theoretical research is of course included in the key points.

This principle of priority must finally be reflected in the annual plans of the science and technology committees at each level. But, because scientific and technical personnel are confined by their specialization and division of labor, it is not possible for them to acquire an overall understanding of the various kinds of urgent problems encountered in economic development. Therefore, the method of simply relying on submitting subjects "from bottom to top" and then on selecting and drawing up the best plan will not be successful. The science committee at each level must fully understand the various kinds of difficulties encountered in economic development, and then it must consider its own strength in making selections and propose anticipated plans. The plans should be publicized, opinions should be solicited, and after repeated revisions, a preliminary plan can be determined. Finally, the plan should be publicized, bids should be taken or negotiations should be organized to determine which unit should be responsible for the plan. This planning procedure that combines "from top to bottom" and "from bottom to top" enables the scientific and technical plan to reflect the urgent problems in economic development.

## II. Science and Technology Must Actively Serve Technical Reforms in Enterprises

The strategy for economic development is undergoing changes, the path of expanding reproduction is gradually changing from [illegible] mainly extensive to being mainly intensive. The so-called intensive [illegible] is to expand productive capabilities via rebuilding under the prerequisite that the original technology does not change. In the course of such expansion of reproduction, the organic composition of capital and its various technical and economic parameters basically do not change. Obviously, in the expansion of reproduction mainly of this type, science and technology do not serve any function, and the natural result will be staggering progress in technology and structural stiffening.

Intensive expansion of reproduction is exactly the opposite. It actively utilizes modern science and technology, improves the internal technological structure of enterprises to expand productive capabilities, i.e., it uses qualitative improvement to realize quantitative expansion. Therefore, while the enterprises use this method to expand production, they also improve their own quality and in this way, national economic growth and national economic improvement are combined. In the course of intensive expansion of reproduction, science and technology can serve their function.

Intensive expansion of reproduction is realized by internal technological renovation and technical improvement of the enterprises. Intensive expansion of reproduction increases the value of products and their useful value via technological renovation and conservation of social labor. Because the key points in conservation are different, technological renovation can be divided into four types.

1. The labor production rate type. The goal of this type is to conserve live labor and improve the labor production rate, such as the use of numerically controlled machine tools, automatic production flow lines, and overall mechanization. After using this kind of technology, technical equipment increases and the amount of labor reduces. They are fully used in the mass production of products. Depreciation of fixed assets increases, the cost of labor drops. If the total cost drops, this of course will be profitable. But, our wages are low and not all technologies that can improve the labor production rate are profitable. For example, in many areas, agricultural mechanization has increased the cost of agriculture. Although [illegible] conserved labor, we must be careful in popularizing and [illegible] that increase cost, and in principle, [illegible] slightly increase [illegible] and increase [illegible] be considered on an overall basis [illegible]. In general, [illegible] should be encouraged and the [illegible] should be [illegible].

2. The [illegible] type. [illegible] the consumption of [illegible] and materials. [illegible]

3. The type that increases equipment efficiency. This type increases output by increasing the efficiency of technical equipment, for example, the increase in production rate brought about by the renovation of equipment of the chemical industry, the improvement of the percentage of coal concentration after using automatically controlled equipment for concentration tests in coal screening plants. This type of technology is frequently combined with improvement in equipment. The purpose is to increase the production rate of equipment, therefore the reduction in the labor force is limited. The use of this type of technology for products that have a developing and unsaturated market is very valuable. In the overall view, it has greatly conserved investment.

4. The type that improves quality. This type of technology is aimed at improving the quality of products to increase the value of the products. This is also a method to expand reproduction. Because we did not conscientiously negotiate prices according to quality, because there was only one price for superior and inferior quality products, therefore, this method to expand reproduction has not been emphasized by people. As the economic system is reformed, the implementation of the principle of "negotiating prices based on quality" should promote this type of new technologies. They should be guaranteed by price policies so that a profit can be made. Actually, this type of superior quality technologies has conserved social labor on an overall basis.

To facilitate analysis, we have divided technological renovation into the four types described above. Actually, every practical technology is a mixture of the four types of technologies described above, only their emphasis is different.

Starting out from the actual situation in our nation's economic development, the above four types of technological renovations have the following order of priority: first, conserve energy consumption and material consumption; second, superior quality; third, improve the production rate of equipment; fourth, increase the [illegible], conserve labor force. Such an arrangement does not mean that we do not want to improve the labor production rate, actually the result of these three types of technological renovations is always an increase in the labor production rate.

We can thus see clearly that starting out from the actual situation in our nation, improving the labor production rate is not the main purpose of technological renovation. The main purpose of technological renovation is to increase [illegible] and must rationally develop the results of [illegible] data, and the improvement in the labor production rate is a natural result.

[illegible] technological improvement of enterprises. [illegible] improvement of enterprises must [illegible] At present, [illegible]

To realize technological improvement of enterprises well, we must first strengthen first level scientific research agencies in enterprises so that scientific research can gradually become the function of the enterprises. At the same time, scientific research agencies at each level must serve the technological improvement of enterprises via various forms such as cooperation in scientific research subjects, transfer of scientific and technical achievements, scientific research service, and technical consultation.

Technological improvement of enterprises must be combined with test manufacturing of new products. The two are related like the tree trunk and its branches and leaves. Technological improvement is the foundation. Only when the trunk is strong can the leaves be prosperous. Now, many enterprises have neglected the improvement of basic technology and have singularly pursued new products. When the market is saturated, the products lose their competitive ability because their technical foundations are poor. This should be a lesson. Therefore, we must combine product development with technological improvement.

When technological improvement of enterprises has been done well, national economic improvement by science and technology will be included.

### III. We Must Fully Develop the Function of Science and Technology, Strengthen the Development of New Products

Supersession of products is the major form of national economic development, and it is also the main manifestation of national economic vitality. If the rate of supersession of products is [illegible] in a nation, then that nation's economy lacks vitality.

The basis for the renewal of products is technological renovation. The nutrients for technological renovation come from two sources: (1) a nation's own scientific and technological achievements, especially achievements in scientific research; (2) advanced foreign technological achievements. Whether it is domestic technology or foreign technology, during the course of innovation into new products, there is always a process for the enterprises themselves to digest it. Therefore, for an enterprise to develop new products well, it must not only emphasize scientific and technical information and market survey, it must place more emphasis on its ability to digest technology. The ability of an enterprise to digest technology is mainly determined by: (1) technical equipment; (2) a rational intellectual structure and comprehensive technical strength of its technical teams; (3) [illegible] management; (4) the degree of technical skill of workers; and (5) [illegible] technological [illegible] in the [illegible] and [illegible] new products, [illegible] and this will [illegible]

The development of new products is an important means to change the product structure in society. A rational product structure is built on the foundation of the rational utilization of resources. It is consistent with social needs. By starting out from the actual situation of our nation's energy sources and resources, we must replace old products with low energy consuming and low material consuming new products in the course of developing new products. This should be an important decision-making principle in the development of new products.

## IV. We Must Establish a Technological System That Suites the National Situation and That Is Suitable for Development

Technologies are mutually related. Efforts to solve the same type of production problems frequently involve technologies of different levels. These technologies are vertically connected. Not only is there an order in time, there is also a logical order, and the order in time and the logical order are often consistent. In addition, different types of technical problems may either be mutually complementary or mutually limiting and they form a complex lateral connection. The entirety of these mutually related technologies is called the technological system.

The technological system is the skeleton of the national economic system. Whether the technological system coincides with the national situation and whether it is suitable for development both exert a great influence upon the development of the national economy. In the past, we did not pay sufficient attention to this problem. The evolution of the technological system was basically unregulated and there was no unified consideration. To establish a rational technological system, we must first determine the principle of selecting the correct technology. This is a very complex problem because technological achievements are manifested in many ways, and the [illegible] of goals that [illegible] from many different angles [illegible] can be formed, and they are frequently mutually limiting. Therefore, this actually is a multiple goal decision-making problem. Starting out from the actual situation in our nation, the selection of technology at present should obey the following principles of priority: (1) consumption of energy and rare and deficient materials; (2) total cost; (3) investment; (4) [illegible] opportunities; (5) environmental pollution.

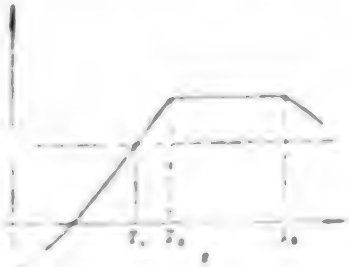
[illegible] technological [illegible] affects the [illegible] national [illegible].

[illegible]

## [illegible] We Should [illegible] on the Popularization of Technology, Establish a Stepwise Technology Transfer System

There are two ways to transfer technology: One is vertical from research to production, and the other is lateral, from advanced enterprises or localities to backward enterprises or localities. Although the first is fundamental, but from the point of view of the social and economic results of science and technology, the second link is very important. When we talk about converting science and technology into a productive force, we always refer to the first link, actually the entire conversion process is the unity of the two links.

We know that frequently the transfer of achievements in basic theoretical research to applied research and the transfer from applied research to developmental research are automatic and do not need promotional efforts. Why is it that when transferring such achievements to production, they encounter difficulties and even very great difficulties? This is a problem that urgently needs to be studied and solved. I personally believe there are two reasons: 1. The economic system has shortcomings. Because of eating from the big pot, the enterprises do not have any vitality, therefore, they do not have an internal need for new technology. It is very difficult to push science and technology forward when there is no social driving force. 2. The utilization of new technology requires investment. Its economic benefits will not manifest themselves suddenly. A rather long period of adaptation is needed before economic benefits better than those produced by old technology can be obtained. During the period of adaptation, new technology frequently does not bring about profits but losses. The [illegible] of economic benefits of new technology can be illustrated by the diagram below.



[illegible]

[illegible]

The current compensatory transfer of technology and the patent system now being drawn up undoubtedly are beneficial to mobilizing the enthusiasm of scientific research departments, design departments and scientific and technical personnel. But, it is worth studying whether they are beneficial to the popularization of technology. The "technology blockade" that has emerged at present is unfavorable to economic development, and "technology blockade" and "compensatory transfer of technology" are mutually prerequisite. Therefore, compensatory transfer of technology provides a resistence to the popularization of technology. I suggest the following system: All new technologies that are economical and practical should be purchased by the state achievements popularization agency. They should then be unconditionally popularized and their popularization should even be subsidized. This not only can protect the enthusiasm of scientific and technical departments, it will also not hinder the popularization of technology. The money spent can be completely recovered from gains after overall popularization of the new technologies has been realized.

Because technological development is imbalanced and because it must follow the laws of gradual progress, it is necessary to establish a stepwise technology transfer system: Advanced regions and enterprises should be grouped at the first level. Advanced scientific and technical achievements and information must be converted to productive forces, and at the same time, we must introduce advanced and suitable foreign technology and digest and absorb it. Then, the digested technology can be transferred to second level regions and enterprises. The emphasis of second level regions and enterprises is on adaptation by suiting measures to local circumstances, and then on popularization one after the other. In this way, advanced technology can be gradually adapted during the course of popularization and rapidly produce economic benefits.

In general, the popularization of new technology requires the use of policy to mobilize the enthusiasm of enterprises supplemented by suitable administrative and organizational work to guarantee it.

[illegible]

## COORDINATED DEVELOPMENT MODEL OF SCIENCE AND TECHNOLOGY, SOCIAL SCIENCES

Beijing RENMIN RIBAO in Chinese 23 Jul 82 p 5

[Article by Zhou Zuhua [6392 4371 5478], Li Xiuguo [2621 4423 2654], Zhou Wenyan [6392 2429 1750], Cao Qingyang [2580 7230 7122] and Yan Zhichao [7051 1807 6389]: "An Enquiry Into a Model For Harmonious Development of Science and Technology and Economic and Social Sciences"]

[Text] The historical trend for contemporary social development is a coordinated development of science and technology and economic and social sciences. In China an issue that requires serious investigation is how to find a specific approach, based on the basic situation in China, to realize a harmonious development of S and T and economic and social sciences.

A review of the progress toward modernization in some developed nations indicates that a universal and imperative model does not exist. The situation of any nation always encompasses merits and shortcomings and advantages and disadvantages. A more successful development strategy is based on the manpower, financial and natural resource conditions and the industrial and agricultural basis, communication and transportation, scientific potential, education level and traditional advantages of a nation. The strategy is to determine the science and technology that the nation under discussion should emphasize and having the potential of success, to establish the complementary industry and to obtain the optimal economic and social benefits. We shall call this approach coordination for advantages.

At the end of the eighteenth century, the capitalistic revolution in Britain swept away the feudal obstacles, led to the development of the capitalistic agriculture and provided great amounts of industrial material. Together with the traditional technological advantages in its textile industry, English products had a wide domestic and overseas market. The industrial revolution in England was therefore led by the technological innovation in textile industry, backed by the development of the engine and quickly formed a series of superior science and technology and industry. It enjoyed enormous economic benefits and occupied the hub of "world factory." Germany did not follow the British approach in its own industrialization. Based on its [illegible] and [illegible] position and its inventions and innovations in the field of electricity, internal combustion engine and organic chemistry, Germany established a series of new industries in electricity, internal combustion engine and chemistry.

This move had allowed Germany to lead the world in S and T and in economic strength during late nineteenth century. Japan has limited land and natural resources but abundant manpower, so it paid special attention to the development of manpower (labor as well as intelligence) and the development of science and technology education. On this basis, Japan selectively imported advanced production technology, modified it and added their own innovation and formed their own S and T and developed a series of superior industries such as automotive, chemical, and steel industries, achieved superiority in international trade and enjoyed sound economic benefits.

The approach taken by Britain, Germany and Japan was not to do many things at once; instead, they formed a series of coordinately developed advantageous technology and industry that suited their national situation which in turn led to the development of other technology and industry and realized the transition from underdevelopment to development. It is fair to say that coordination for advantages is the footing of development strategy for underdeveloped nations.

Coordination for advantage is a complete chain and its center link is the development of advantageous technology. In choosing a development strategy for S and T development, one should naturally take the current overall development characteristics and trend into account and identify the possible breakthrough points and "rich areas" that might bring fruitful results. However, to solve the strategy problem of a nation's S and T development, it is not enough to confine the considerations solely on the S and T system itself. Because of the elevated status and the expanded function, modern science and technology has become an enormous force of promotion for economic and social development. The direction, scope and speed of development are constrained by the needs of social development and the conditions it provides. Therefore, the discussion of S and T development strategy cannot be confined only to science and technology but should be investigated in terms of the needs and potentials in science and technology, and economic and social sciences. To develop an advantageous S and T, coordination and overall arrangement must be carried out for S and T and economic and social sciences.

Based on the above viewpoint and the basic situation in China, we believe that we should start from our resources and other conditions, select a series of industry and associated S and T for priority development and for an [illegible] industry and technology that is characteristic of the Chinese [illegible].

China has many superior mineral resources. For example, China has the world's largest reserves of tungsten, antimony, and rare earth elements. Reserves of tin, lead, zinc, nickel, aluminum, molybdenum, vanadium and titanium are also among the richest in the world. Nonferrous metals are a great advantage of China. Because they are indispensable to defense, industry, modern science and technology, and the livelihood of the people, and [illegible] demand on them both domestic and foreign, the market is very [illegible] a series of advantageous [illegible] favorable mineral resources [illegible]

[illegible] nonferrous metals. The [illegible] research and development and the establishment [illegible] prospecting, mining, dressing, refining, extensive [illegible] manufacturing based on new technology, method, [illegible] product variety. Only then can the advantageous [illegible] and utilized and the advantageous industry can [illegible] products will have an edge on the market. The [illegible] and petroleum resources should be handled [illegible]

[illegible] advantageous regions. For example, Hainan [illegible] subtropical zone, is suited for planting many [illegible] value and has many precious botanical specimens [illegible] rich in grass land and aquatic resources and has [illegible] outstanding advantages. But, due to a number of [illegible] are not fully undeveloped, there has [illegible] ing them. To develop this wonderful island and [illegible] zone, we must develop the associated science and [illegible] ensuing a correct policy. As long as we coordinate [illegible] S and T and economic and social sciences [illegible] the development task, the day will come when this [illegible] prosperity.

[illegible] and traditional advantages. For example, the [illegible], the China of Jingdezhen, Chinese herb medicine [illegible] of various places, the world famous Chinese [illegible] and famous scenic spots and places of [illegible]. These are unique creations of the Chinese people and [illegible] tradition. But, in today's rapid progress of S and T, [illegible] established practice and not using modern technology [illegible] and add luster to our traditional advantages, [illegible] traditional advantages will be greatly limited and we may [illegible] traditional advantages. We must strengthen the effort [illegible] new level and we may continue to [illegible] development in this area may form a unique industry [illegible]. It may with the results of modern S and T and [illegible], making a great labor force with [illegible] economic and social benefits.

[illegible] are relatively [illegible] advanced fields be centered around big cities that [illegible] we should make full use of their abundant talents, [illegible] sophisticated equipment, and facilities and [illegible] of these areas [illegible] universities [illegible] strive for an [illegible] market.

Of course our advantages are not limited to the ones mentioned here and there are more industries and technologies that we should develop. We have merely enumerated some examples. The basic idea is that we should develop all the potential advantages, enhance the existing advantages, actively create future advantages, develop a variety of advantageous science and technology, establish various advantageous industries and seek the optimum economic and social benefits.

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CSO: 4008/108

## DEVELOPMENT OF ENTERPRISE 'TRIPLE COMBINATION' PROGRAMS DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Sep 82 pp 8-11

[Article by Jia Huo [0328 3499], Tianjin Municipal Scientific and Technical Commission: "Several Problems Regarding the Compilation of Programs for 'Triple-Combination' of Enterprises"]

[Text] In order to promote coordinated scientific-technical, economic and social development, the Central Committee requests that we integrate into the Sixth Five-Year Plan programs for scientific and technical development and social and economic development. In order to do this work conscientiously and effectively, after studying the relevant Central Committee directives, we carried out some spot experiments involving the combination of scientific-technical, social and economic development (referred to below as the "triple combination") in the bicycle and knitwear industries.

The three elements, science-technology, the economy and society, affect, condition, limit and promote each other, and accordingly scientific-technical, economic and social development should be coordinated. But there are many specific problems in truly implementing a program for "triple combination." Our spot experiments have demonstrated that there are at least four problems that must be solved first.

### I. Who Should Have the Leading Role in Developing "Triple Combination" Programs

Our spot experiments in drafting "triple combination" programs did away with the past practice of having each functional development develop them separately "by the book"; we strengthened centralized guidance and determined what the "leading" departments were. We established a citywide [illegible] leadership group headed by a leadership comrade from the municipal party committee and responsible comrades from the three major commissions (planning commission, economic commission and scientific and technical commission); we also established specialized program groups for the industrial branches, headed by the general managers of the industrial [illegible] and their chief engineers. Involved in specific planning work were: the three main committees at the city level, the planning, [illegible] level, and personnel of the planning, [illegible] marketing, labor, financial, [illegible] departments at the company level; in addition, we invited economic personnel from the domestic trade, foreign trade and municipal scientific and technical information offices and universities and scientific research units to participate.

We organized the drafting of the specific programs with the overall planning departments taking the lead. There are two reasons for this.

A. The economic commissions at the various levels are the economic staffs of the various party and government organs; they are the overall planning departments, and their main task is to organize effective drafting of state or regional plans for integrated economic and social development. "Triple combination" programs are integrated programs for coordinated scientific-technical, economic and social development, and naturally the economic commissions at the various levels should take the lead in drafting them.

B. Within the specialized management offices and specialized companies, only the planning departments can organically coordinate the production, supply and marketing, science and technology, capital construction, labor and [illegible] departments and take on the work of integrating, balancing, interconnecting and coordinating the various programs.

Because of the position and role of the overall planning departments in the drafting of programs, the various cognizant bureaus and industrial companies should [illegible] overall planning departments and see that they function effectively in accordance with the specific circumstances.

[illegible] planning department takes the lead in program work and [illegible] in liaison with the other relevant departments; at the same time, the other departments must take the initiative in coordination with the planning departments and must not wait passively; in addition, [illegible] departments must intermeshate their specific circumstances and [illegible]

[illegible] "Triple Combination" Programs

[illegible]

[illegible]

[illegible]

C. A program for technical modernization: this is the focal point of the "triple combination" program and includes programs for modernization of enterprise production technology and equipment, modernization of measurement and testing techniques, and modernization of scientific experimentation techniques.

D. A capital construction program, including a program for production-related construction, a program for construction of a scientific research base and a program for construction of employee domestic and welfare facilities, particularly employee housing.

E. A product export development plan, including plans for export of products and parts and assemblies.

F. An environmental protection program, including prevention of pollution by waste products and decreasing or elimination of noise.

G. A personnel development program, including employee development (scientific and technical personnel, management personnel and workers), training and upgrading of existing personnel, training of new personnel, and expansion or development of schools of various types within the industry.

H. An energy requirements program, including coal, oil, gas and electricity requirements.

I. A materials requirements plan, indicating the main raw and other materials needed by the production development program, the technical modernization program and the capital construction program.

J. A fund sources and balance program: funds sources include a depreciation fund, the enterprise's own funds, bank loans and state investment; balancing includes rational distribution of funds to capital construction, technical modernization, scientific and technical development and the like.

In addition, other development programs may be added in accordance with the circumstances of specific industries, such as water use programs, industry geographical distribution programs, enterprise readjustment and reorganization programs and the like.

III. What Sequence Should Be Followed in Drafting "Triple Combination" Programs

Tianjin City carried out its spot experiments with [illegible] programs during a very short period and limited them to two consumer goods industries, so that they were very partial in nature; as a result we cannot yet generalize a set of fully satisfactory procedures for drafting "triple combination" programs, but can only offer a few preliminary opinions for reference.

The drafting steps we consider [illegible] research, [illegible], the drafting itself, and overall evaluation.

3. Surveys and research. These are the foundation for work on the programs and have very broad scope, with five main [illegible]:

1. Survey of social needs. This includes the needs of the people's livelihood, of production-related construction, and of scientific research. Social needs should be surveyed with respect to product specifications, varieties, colors and designs, quality, quantities and prices. Survey methods include collecting and analyzing multiyear statistics on supply, sales, dispatching, inventory and the like, and collecting social opinion regarding products. These surveys are done jointly, led by the supply and marketing departments of industrial companies, with the participation of the production and technical departments and foreign and domestic trade units.

2. Survey of process technology and equipment. When developing the programs it is necessary to gain a clear picture of the conditions of process technology and equipment and to make comparisons with similar products and processes in this country and abroad in terms of product quality, production efficiency, consumption, equipment operation and maintenance, labor conditions, manpower, environmental pollution and the like, and to find the backward links. This research can be carried out by key engineering and technical personnel in enterprises of the industry which organizes the technology and by experts with practical experience.

3. Survey and selection of relevant technical results. The scientific research departments should survey and select relevant scientific research results in this country and abroad, in their own districts and outside them, and in their own industries and elsewhere, as well as military results made available to the civilian sector. They should select truly advanced, mature, applicable, economically rational scientific research results and recommend them to the departments responsible for technical modernization or capital construction. The scientific and technical information departments at all levels should help the basic levels to gain an understanding of research results outside their industries or enterprises. For example, while the drafting of "triple combination" programs at the industry [illegible] was expanding in Tianjin, the municipal scientific and technical committee instructed the [illegible] scientific and technical information [illegible] to hold an exhibition [illegible] of scientific research results. Following surveys and collection, the exhibit exhibited more than [illegible] volumes of recent domestic and foreign scientific and technical documents, providing timely information on scientific research results for the drafting of "triple combination" programs in various industries.

4. Survey of the situation regarding scientific and technical personnel. [illegible], overall analysis of scientific and technical personnel in terms of [illegible], specialty, age, education and [illegible] distribution should be [illegible] and cases of [illegible] readjustment [illegible].

5. [illegible] departments' [illegible] technical and economic [illegible] funds, [illegible] output value,

and labor productivity [illegible] in their quality and output, [illegible] the department's own and [illegible] highest levels; [illegible] their [illegible] in order to provide data for drafting [illegible] measures. [illegible] surveys and analyses [illegible] marily by the production and financial departments.

Other problems [illegible] the energy supply and [illegible], [illegible] geographical distribution [illegible] may be surveyed in accordance with the specific [illegible] industries.

B. Forecasting. Forecasting is carried [illegible] year of the main areas are economic and technical [illegible].

1. Economic forecasting: primarily at the [illegible]. The separate forecasts for different varieties and [illegible] products should be done to determine overall production [illegible] and to organize [illegible] production development [illegible] and [illegible] trial production of new products.

2. Technical forecasting: directions of technical development within the program period and attainable technical levels are forecast [illegible] surveys of trends in domestic and foreign technical development [illegible] within the [illegible] industry; these, together with knowledge of key problems and lagging areas in existing technologies, are used as guidance in designating key scientific research topics.

C. Drafting of the program. On the basis of the [illegible], the overall development targets are first designated, then the [illegible] specific [illegible] are drafted; the work can be divided into four areas.

1. Drafting the technical modernization program, the capital construction program and the environmental protection program. On the basis of surveys of the status of existing technologies and equipment and the environmental situation, using the scientific results that have been [illegible], and taking account of specific actual production conditions, [illegible] technical modernization program for [illegible] and protecting the environment should be [illegible], [illegible] most urgently requiring [illegible]. [illegible] possible in most [illegible]. [illegible] be drafted.

2. [illegible] and technical [illegible] program. In drawing on the [illegible] should be [illegible] in terms of current [illegible] technical development [illegible]

[illegible] the scientific research program [illegible] development plan is drawn up [illegible] society, the [illegible] production of new products, and [illegible] the enterprise will be able to [illegible] modernization program is completed.

[illegible] export program and [illegible] development program. [illegible] export program is developed on the basis of forecasts of requirements of international markets and the production development program. The [illegible] development program is drawn up following surveys of the existing [illegible] and internal readjustments, and is based on the production development program and the scientific and technical development program.

[illegible] requirements program, a [illegible] and other materials requirements program and a funds and balance program. Energy conservation which will result from technical modernization and the implementation [illegible] consumption is taken into account in drawing up the [illegible] and the material requirements program, which is [illegible] production development program and scientific and [illegible] program. The program for requirements of the "three [illegible]" is drawn up on the basis of the technical modernization program and the capital construction program. The various funds requirements programs are drawn up on the basis of the production, scientific and [illegible] development, technical modernization and capital construction [illegible]

[illegible] programs should take account of the supply capabilities [illegible] requirements, and if they cannot meet needs, [illegible] should be provided [illegible] production, [illegible] capital construction plans revised.

[illegible] review. When the various programs are drafted, [illegible] in order to [illegible] results. [illegible] should include: [illegible] will be met [illegible] quality [illegible] specifications, varieties, designs [illegible] materials [illegible] environmental [illegible] technical reserve; [illegible] technical and economic indicators [illegible]

[illegible] foreign [illegible]

[illegible]

[illegible] is the primary area in which science and technology [illegible] applied; it reflects whether or not the program takes [illegible] [illegible] primarily through intensive factors, and whether or [illegible] [illegible] the [illegible] relying on science and technology [illegible] tion.

[illegible] Whether the production program is in accord with societ[illegible] needs. This is an important embodiment of coordinated economic and social [illegible]

[illegible] Whether the scientific and technical development program [illegible] search topics in accordance with the needs of economic and social [illegible] ment. This involves the question of scientific and technical devel[illegible] [illegible] and whether science and technology treat [illegible] [illegible] cial development as their main task.

[illegible] Whether the personnel capabilities development program, and [illegible] the program for development and training of scientific and [illegible] nel, are based on the needs of scientific-technical development and production-related construction development, whether they propose new programs [illegible] rational readjustment and utilization of existing personnel [illegible] keeping with actual needs and specialties.

[illegible] Whether handling of waste pollution and environmental protection are included in the "triple combination" plan and are provided with [illegible] effective, practical implementation measures: this is an important [illegible] question whose solution must be given particular attention in [illegible] and economic development.

[illegible] Whether, at the same time as production development, attention [illegible] to improvement of the employees' living conditions, in accordance with [illegible] ing possibilities, and particularly whether the problem of scarce employee housing is somewhat alleviated.

[illegible] comprehensive technical and economic evaluation should [illegible] whether the coordinated scientific-technical, economic and social [illegible] ment program will attain better economic results.

[illegible] is now gradually expanding the range of industries [illegible] "triple combination" programs are being drafted. [illegible] new problems will require our study and investigation. [illegible] [illegible] our views regarding the [illegible] we wish, together with other comrades in the same field, to [illegible] [illegible] up and exchange experiences, and [illegible] [illegible] that the work of drafting "triple combination" [illegible] [illegible] will be rapidly improved both theoretically and practically.

## APPLICABILITY OF MILITARY TECHNOLOGY TO CIVILIAN ECONOMY DETAILED

Beijing KEXUE GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No [illegible], [illegible] 82 pp 14-19

[Article by Sun Jianmin [illegible] of the Investigative Research Office of the Ministry of Aviation Industry: "On Transferring Purely Military Technology to Military and Civilian Use"]

[Text] Premier Zhao Ziyang clearly asked us to organize efforts to transfer purely military technology into technology for military and civilian use as well in the administrative work report to the Fourth Meeting of the Fifth National People's Congress. Therefore, conscientiously studying this problem has a very important meaning.

I. The Possibility and Superiority of Transferring Purely Military Technology into Technology for Military and Civilian Use

Because of the special needs in modern warfare, many industrially advanced nations of the world not only pay special attention to applying the achievements of advanced science and technology in the military realm, they also are willing to spend a lot of manpower, money and materials to conduct exploratory research in military science and technology. For example, after the Second World War, the United States led the world in many scientific and technological fields. According to statistics, [illegible] percent of the most important technological innovations realized in the [illegible] first [illegible] after the war were first developed successfully in the United States, and [illegible] percent of them were first applied in the United States. The advanced position of the United States is related to a very large extent to achievements realized by the large amount of expenditures for scientific research funds allocated for military purposes by such national agencies as [illegible] and NASA. From [illegible] to [illegible], the amount of scientific research funds for the military each year in the United States generally constituted about [illegible] percent of the total amount of scientific research funds of the nation. Such newly emerged sectors as the computer industry, semiconductor industry, aviation, space science and atomic energy [illegible] of military technology. These newly emerged [illegible] traditional agriculture and light industry. [illegible] result in practical [illegible] in production, and [illegible] economy [illegible] wide scale. [illegible]

[illegible] mental disorders.

[illegible]

[illegible]

[illegible]

[illegible]

to develop military strength is different, some for self-defense, some for invasion and domination). The utilization of advanced military technology realized at a high cost to serve economic development undoubtedly will lessen the economic pressure. Actually, the three aspects mentioned previously will all be manifested as economic results. We will take energy as another example. Everyone knows that a nation's economic development is determined to a large degree by the development and utilization of energy. Nuclear power is an energy source that has a rich reserve. Since the time the world's first nuclear power station was built at the beginning of the 1950s, already over 20 nations and regions have built more than 200 nuclear stations with total installed capacity surpassing 100 million kilowatts. Some people estimate that by the end of this century, the amount of electricity generated by nuclear power stations will reach 30 to 40 percent of the total amount of electricity generated throughout the world. This will surely serve a major function in economic development as the supply of petroleum and natural gas declines. Also, for example, some advanced management methods which are being applied more widely like systems engineering were also developed first in the military sector. Their popularization among the civilian sectors similarly will help improve economic results.

(V) It Can Act Inversely to Improve the Level of Military Science and Technology and Strengthen National Defense. As a whole, a nation's military power is determined at the end by its economic foundation. A nation must be rich before its armed forces can be strong. Only by transferring military technology to civilian use and by improving the level of science and technology and the economic strength of the entire nation can the nation invest more funds in national defense scientific research and strengthen national defense forces. At the same time, military engineering units can also learn things needed by themselves in civilian technology during the course of technology transfer and use the advantages to make up for shortcomings. There are many such cases and they will not be repeated here.

In general, the transfer of purely military technology into technology for military and civilian use is necessary and possible. It is an important way to improve the nation's level of science and technology and national economic benefits, it is also an important aspect in implementing the principle of combing the military and the civilian sectors, and it benefits both the military and the civilian sectors.

## II. Conditions and Methods of Transfer

The scope of transferring military technology to civilian use is broad. But, this does not mean all military technologies can be unconditionally transferred to civilian use. The nuclear submarine began service in 1954. Now, the world has a total of about 300 nuclear submarines including those being built. We could say that the technology is relatively mature. But, few nuclear powered civilian vessels have been used. One reason is the economic problem. Because the nuclear submarine can navigate for long periods underwater, therefore, even though the building cost of each vessel reaches 1 billion US dollars, the United States military sector still believes nuclear powered submarines must be commissioned as early as possible. But, it is not worth the effort to manufacture civilian nuclear powered vessels at such a high cost. At the same time, ordinary vessels must carry many people, therefore its safety must be guaranteed. This is very difficult to realize in a nuclear powered vessel at once. This case shows that to transfer military technology for civilian use, the general requirements of civilian technology must be satisfied.

Analysis of various aspects shows that to popularize and apply scientific and technical achievements, at least the following three conditions must be satisfied, i.e.: Production needs must be satisfied, there must be economic gains, and the technology must be suited to the production level and the technological levels of that time and place. We believe, it is suitable to use these three as conditions for the transfer of military technology for civilian use.

What we call the necessity to satisfy production needs means that social needs must be satisfied. The direction of development of science and technology, fundamentally speaking, is determined by the needs in modern production. "When society has a technical need, this need will be more powerful than ten universities in pushing forward science" ("Selected Works of Marx and Engels", volume 4, page 505). Of course, military needs are also social needs, but they are a special kind of need. The need to produce civilian products is a more common and more frequent need. If military technology cannot satisfy the needs in producing civilian commercial products, or at least within a short period it cannot satisfy such needs, then its transfer for civilian use will lose its driving force. The technology of long-range guided missiles itself is very advanced, but up to now, it has not been applied in civilian applications too much because of the above reason. Conversely, if military technology can satisfy the needs of civilian production, it will be quickly popularized. The electronics technology and nuclear science and technology mentioned above all illustrate this problem.

The key to whether military technology can be transferred to civilian use is whether it produces any economic gain. Some people abroad believe that it is more difficult to study civilian technology than military technology. The difficulty lies in economics and safety. For military needs, a nation sometimes can disregard cost. Nuclear submarine belongs to this category. Civilian technology cannot disregard cost. It must place safety and especially economic in an outstanding position. In other words, the criteria for evaluating military and civilian technologies are very different. According to this characteristic, three major situations will occur in the transfer of military technology for civilian use: (1) The technology is advanced but the economic benefits are poor and the cost is high; (2) The technology is ordinary, but the economic benefits are ordinary or slightly better; (3) The technology is advanced and the economic benefits are also relatively high. Therefore, we must conscientiously select and decide cautiously to avoid blindness. Of course, this also includes technological maturity. It is very difficult for an immature technology to be economical in large scale production. This has been proven by many facts.

To suit the level of production and the technological level at a certain time and place, we must start out from the actual situation, and suit measures to the circumstances of the time and the place. We cannot blindly pursue sophistication, precision, pioneering technologies and jump on the bandwagon. Airplanes are faster than automobiles, trains and ships. Everyone knows this. But at present, most people in our nation do not take the airplane. The reason is that it costs more to take the plane and it is less convenient than riding the motor car, trains and ships. Now everyone is talking about "suitable technology." "Suitable technology" means that we must pay attention to our own "soil" and "foundation" when selecting technologies, we cannot pull the seedlings to help them grow. This must be fully noted when organizing the transfer of military technology.

In addition, because of the special nature of military technology, we must also consider secrecy. We cannot leak secrets when transferring technology.

The several conditions described above are remarks concerning the general situation in transferring military technology for civilian use. Actually, every slightly more complex technology consists of many minute technologies. Therefore, we must analyze the concrete situation to decide which technology can be transferred and which cannot be transferred. Even if there are technologies that can be transferred, there still is the question of selecting the most suitable method of transfer. In view of the domestic and foreign situation, there are many methods of transfer that can be selected. The most important ones are:

(I) We Must Join the Military and Civilian Sectors Together. Military Enterprises Can Produce Civilian Goods or Civilian Enterprises Can Manufacture Military Goods. This is the simplest way to transfer military technology for civilian use. In some industrially developed nations in the West, there are very few enterprises that truly and purely manufacture military products. Most tasks to produce military goods are carried out by so-called "civilian enterprises." For example, one third of industrial enterprises in the United States constantly perform tasks to produce military goods. The enterprises of various professions participating in the production of military goods are different. Eighty percent of the aviation industry manufacture military products, 60 percent of the shipbuilding industry do so, about 40 percent of the electronics industry do so, about 34 percent of the electrical engineering industry do so, about 28 percent of the general purpose machinery industry do so. They have taken the "maintenance of mixed production of military products and civilian products" as an important and successful experience, and they believe that "this will help the transfer of technology and will help to stabilize the load of production equipment and the capabilities of the work shifts." In recent years, our nation's military industries have implemented the principle of the alliance of the military and civilian sectors and greatly developed the production of civilian products. This not only utilizes the large number of unused technical facilities of the enterprises of the military industries, it also "unconsciously" realizes a transfer of technology. This does not require the state to spend a lot of money. It is killing several birds with one stone and it should be greatly promoted.

(II) We Must Provide Technical Services to the Civilian Sector. There are many ways to realize this. For example: (1) Industrial enterprises of the military sector can conduct civilian scientific research and tests. Like NASA of the United States, which mainly conducts scientific research tasks in aviation and spaceflights, also conducts a lot of civilian scientific research tasks. There are even more cases of using military scientific research testing equipment to serve the civilian sectors, like the use of military wind tunnels to perform wind tests for passenger aircraft, high speed automobiles and models of highrise buildings. (2) The utilization of military scientific and technological achievements to design new commercial products is done mainly by utilizing the design elements (design standards, blueprints, formulas, data) to develop new commercial products. This is called "the transfer of designs" abroad. (3) Efforts to directly serve technical reforms for the national economy have been carried out. In recent years, our nation's military industries have provided sizing machines, porcelain manufacturing machinery, automatic bread production lines for the light industry and textile industry. They have all realized better results.

(III) We Must Transfer Capabilities, Such As Scientific and Technical Knowledge and Managerial Experience. For example: (1) We must broadly exchange scientific and technical information. While not affecting national secrets, information of military science and technology should be transferred to civilian sectors in time. This can enlarge the scope for selecting technologies by the civilian sectors and can also avoid redundant development. (2) We should exchange scientific and technical personnel. Some scientific and technical personnel of military industries should be transferred to civilian sectors or allowed to carry out civilian scientific research tasks. Similarly, knowledge of military science and technology can be brought into the civilian sector to realize a transfer of technology. (3) We should provide technical consultation services to help civilian units carry out technical and economic proofs, to review and examine design plans and blueprints and to overcome technical difficulties.

(IV) We Should Establish Joint Ventures in Scientific Research and Production, and Push Forward the Combination of Military Scientific Research and Civilian Production. To adapt to the modern trend of a close combination of "science-technology-production," the United States and the Soviet Union have since the 1960s organized units in scientific research and design agencies, laboratories and experimental factories and batch production factories around large scientific research agencies according to different tasks and gradually established a group of joint ventures in scientific research and production. According to published reports, these organizations can promote the direct conversion of science and technology into productive forces, shorten the renewal period of products and equipment. They are a good way to convert scientific and technical achievements from the laboratory to the factory and they are also a good way to transfer purely military technologies into technologies of military and civilian use.

The several methods above may be categorized into two main types: One type is military enterprises producing civilian products or civilian enterprises producing military products. Although the emphasis is on products, but at the same time, it can also serve to transfer technology, therefore let us call it indirect transfer. The other type is to popularize science and technology developed from military needs to civilian sectors, and this can be called direct transfer. Because everyone at present has already paid more attention to the previous method, especially the question of how to develop the function of technical equipment of military industries, the following discussion will mainly emphasize direct transfer.

## III. Several Opinions Concerning How to Hasten the Progress in Transferring Our Nation's Military Technology

After more than 30 years of construction, our nation's national defense industry has acquired a relatively large scale and foundation. Compared to ordinary civilian industrial sectors, it has a definite superiority in science and technology. In recent years, the national defense industry has exerted efforts to develop civilian products under the prerequisite of guaranteeing combat needs. A lot of work has been done to transfer military technology to civilian use. But, compared to the requirements of the four modernizations, such efforts are not sufficient. As readjustment and reforms deepen, our nation's national economy is undergoing a fundamental change. Conscientiously improving the transfer of purely military technology to technology for military and civilian use is an important content of this change. We should aim at the problems that existed in the past and their reasons to take forceful measures and to greatly push this work forward. Some immature views are presented below for everyone to discuss.

(I) We Should Expand the Scope of Service of Military Industries, Clarify Key Points in Transferring Technology. To make the national defense industry a comprehensive machinery industry based on science and technology, we must guarantee combat needs as a priority and we must also fully develop our own superiority, exert efforts to serve technical reforms in the national economy, to serve the life of the people and the masses and to serve the expansion of exports. For this, we must continue to implement the principle of the alliance between the military and the civilian sectors, and we must especially improve our understanding of the transfer of military technology to truly grasp its implementation. On the one hand, we must utilize existing scientific and technical achievements and advanced technology, greatly develop new commercial products. On the other hand, as we carry out current scientific research subjects and projects or consider those which are about to be carried out, we must also consider the question of transferring them to civilian use. At the same time, we must actively participate in key scientific research projects organized nationally and locally. Because the principle of our nation's future economic development must change from being mainly "extensive" in the past to mainly being "intensive," the tasks of technical reform of each sector are heavy, and the main emphasis in transferring military technology for civilian use must be placed on various sectors of the national economy, especially on technical reforms in the light industry and textile industry, energy, transportation, agriculture and forestry to rapidly produced results.

(II) We Should Improve the Management System and Strengthen Organization and Leadership. For many years, our nation's national defense industry and the civilian industry have always been separately managed. The sectors within the national defense industry also form their own systems and do things in their own ways. At the same time, scientific and technical plans are not connected to the civilian scientific and technical plans. The distribution of scientific research funds is not based on scientific research subjects and projects but on "lines" and they are separated. As a result, the military and the civilian sectors do not communicate with each other and "each sweeps the snow from his own front porch". The question of "combined departments" is not emphasized ideologically, the organization is not guaranteed, there are no funds, and lateral transfer of scientific and technological achievements is full of obstacles.

To overcome these shortcomings, we must carry out reforms: (1) In view of the experience abroad and the long range future, we should break the boundary between the military and the civilian sectors, we should establish a management system that unifies the military and the civilian sectors into one entity according to the principles of specialization and cooperation, we must truly realize the alliance of the military and civilian sectors, we must include the military industry within the civilian industrial sector. This would benefit the lateral transfer of technology and improve economic benefits and also strengthen war preparedness. (2) We should concretely change the situation in which scientific and technical plans are unconnected and military scientific and technical plans and civilian scientific and technical plans are unconnected, we must strive to avoid unnecessary redundancy, and insist on stopping wastefulness. The popularization and application of key military scientific and technical achievements that require more investment and that produce a greater influence on the national economy should be included in the nation's general plan, we should arrange necessary capital construction and scientific research funds, guarantee that the supply of raw materials matches the technology, and prevent incomplete facilities. (3) We should gradually reform the past method of providing funds according to "traditional ratios" and distribute scientific research funds to "lines" separately. We should implement a distribution of funds according to tasks (subjects or projects, models), conduct strict accounting, contract work by levels, allow units to retain surplus and savings, stop subsidies for overexpenditure, and penalize unfinished tasks. Because it is difficult to implement the method of compensatory use of scientific research funds in the military industry units, the above method was first tested in certain subjects or projects which can be used for both military and civilian purposes. This means, after completing specific scientific research tasks and applying them in production, concerned departments must partially or wholly repay the scientific research funds provided by the state to stimulate the scientific research units to care about the popularization and application of their own achievements.

(III) We Must Establish a Rational Economic Policy and Mobilize the Enthusiasm of Each Sector. An absolute majority of our nation's military industry enterprises and military scientific research and design units has been established for one military product. They are not responsible for transferring military technology for civilian use. Even if we organize the popularization of scientific and technical achievements for civilian use, we will not realize any benefits, therefore there is a lack of initiative. In the past, the products of civilian enterprises, regardless of the product, were procured and marketed by the state and there is no pressure to use new technology and develop new products. Even when developing new products, funds were provided by the state, therefore the units rather carry out new research and development than take the initiative to use already mature and usable scientific and technical achievements (including military scientific and technical achievements). And with the addition of such factors as price and taxes, some enterprises will realize less profits if they develop new products.

To solve these problems, we must reform the system, readjust the pricing policy and the taxation policy, mobilize the enthusiasm of civilian enterprises to develop new products and utilize new technology, and we must also study the policy towards units of the military industry in a key way so that they can acquire an enthusiasm to transfer technology. The method of providing scientific research funds for contract work and for compensatory use mentioned previously are an important economic policy. In addition, we should consider the following: (1) There must be a compensatory transfer of some scientific and technical achievements. Our nation's military industry units are all established with state investment, and scientific and technical achievements are also realized with state investment. In principle, they are duty-bound to provide such achievements for use by other units. But, to transfer military technologies for civilian use, we must spend a definite amount of labor and capital. Therefore, all military technologies and scientific and technical achievements that are not included in state plans and that do not have special funds for popularization should be subjected to compensatory transfer to strengthen the responsibility of both sectors in popularization and application. (2) Military scientific research units that generate income from actively transferring technology should be allowed to keep all or most of the income for use by their own units as funds to strengthen their means of scientific research and to improve the life of their workers. The supervisory departments have the authority to guide and supervise the use of this income, but they cannot forcefully confiscate the money or confiscate it in a disguised way. (3) We should strictly implement the contract system, clearly specify the economic responsibilities of both sides in transferring technology, strengthen economic management and prevent disputes.

(IV) We Should Strengthen the Exchange of Scientific and Technical Information. Not emphasizing the collection, use and exchange of information is a major shortcoming in our nation's scientific and technical work. Because of the limitations on secrecy, this shortcoming is worse in the military industrial departments. We believe, under present domestic and foreign conditions, the advocacy to cancel secrecy limitations and make everything public undoubtedly is very wrong. The problem is to correctly draw the lines for secrecy and to divide the subjects to be kept secret. In our nation, in principle, we should not refuse to exchange information in the name of secrecy, but the method of exchange must be appropriately considered.

As to how to strengthen the exchange of scientific and technical information, there are three points based on the characteristics of the military industry departments that need to be considered: (1) The scientific and technical information agencies of the various of the military industries should carry out the transfer of military technology as constant work, gather information and data in time, exchange information well. (2) We should fully develop the function of the related societies subordinate to the Chinese Science Association (The Aviation Society, Nuclear Science Association), frequently publish in-house communiques on scientific and technical achievements and various types of academic publications. (3) The military industry departments should hold many lectures on special subjects, training classes and exhibits of new technologies, new materials and new techniques to expand the range of selection of technologies by civilian units.

In addition, in the past, the management of our nation's scientific and technical personnel has also been very stringent, basically they are assigned life-long jobs. Therefore, some localities have people who do not have anything to do, such as the military industry departments. Other localities have jobs without anybody to do them, such as the light textile sector. In March of this year, the related departments of the state issued two documents, the "temporary methods to hire scientific and technical personnel to serve concurrent jobs" and "temporary methods to implement exchange of scientific and technical personnel." Efforts have begun to solve this problem. Concerned military industry units should insist on implementing the spirit of these two documents, truly allow people to develop their talent and fully develop the function of scientific and technical personnel.

Transferring military technology for civilian use is a major task, and it is also a new task, and at present, everyone lacks experience. We should gradually explore, continue to progress so that military technology can serve national defense development and national economic development.

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# INSTITUTE URGES COMBINING MILITARY, CIVILIAN RESEARCH

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 61-66

[Article by the Nanhua Power Machinery Research Institute: "Exert Efforts To Carry Out the 'Three Transfers' Well and Energetically Promote the Development of Scientific Research on Civilian Products"]

[Text] Our Nanhua Power Machinery Research Institute is a comprehensive design research institute serving the national defense buildup. It has several hundred engineers including complete mechanical and electrical staffs. It has a ability in test-manufacturing and some experimental capabilities and some means of testing. Conscientiously implementing the policy of developing science and technology to serve national economic development issued by the Central Committee, we persistently combined military and civilian endeavors, with emphasis on military endeavors. We exerted efforts to transfer scientific research technology from the laboratory to production, to transfer products for purely military use to both military and civilian use, to import foreign technology into out nation, and to strengthen scientific research management. We promoted the development of scientific research on civilian products, and enabled our institute to progress and develop steadily during the economic readjustment.

## (I)

In the past, we did not have a profound understanding of the significance of combining military and civilian endeavors. Some comrades believed that developing civilian products was an "extra burden" and was "not doing our proper work." Some scientific and technical personnel worried that developing civilian products would "waste technology," "affect specialization," and "be a blow to military industry." Because our institute had nto been completed, because it was a purely military production agency, and because scientific research funding was cut back again and again, there were not many tasks, and for a while we were in a "half starving" state. Many jobs were unstalbe, discipline was lax, ideas were in disorder. The entire institute was short of money. During the first half of 1979, the research laboratory rushed to divide up the scientific research funds, and by the 3d quarter, even money for automobile road tolls could not be paid. In this passive situation, we had to decide whether to progress further or retreat, whether to do something or to do nothing, whether to carry out readjustment actively or passively. We used the Central Committee's policy of energetic readjustment and stabilizing the economy as a guide, grasped the above problems and carried out repeated study and discussion. We gradually recognized that converting our purely military production structure to a scientific research structure that combined military and civilian endeavors, and expanding national defense scientific research are objective requirements for the development of the socialist economy and they are long-range strategic measures to carry out the four modernizations, as well as an important aspect of national economic readjustment. Thus we improved our awareness of persistently combining military and civilian endeavors, lifted out spirits, carried out scientific research for civilian products while guaranteeing completion of scientific research for military products, and took a gratifying step forward. Over the past 2 years, our institute has successfully developed our nation's first automatic bread production line for the food industry; transferred scientific research achievements of four types of precision testing instruments to civilian enterprises; developed the axis tracer for universities and colleges; provided a laser for holographic photography for educational use; drawn up blueprints for four improved models of automatic mat weaving looms for the light industries enterprises; developed a yarn winder and a packaging machine for balls of yarn, an automatic shaping machine for rail steel and a dynamic meter to measure the change in direction of locomotives for the transportation sector, an emulsified asphalt mixing machine for the construction sector and a straw hat shaping machine for the commercial services sector; designed an automatic production line and trail produced medicated leaven and glutinous rehmannia for the medical sector; studied the continuous production technique for degumming ramie for the textile industry; and studied the development of an inertial fire extinguisher to be used in tunnels for the coal industry. In addition, we have provided technical services and technical cooperation, served as technical adviser to factories, opened up the road for scientific research of civilian products, opened up the situation, and fully manifested the technical superiority of the research institute.

As scientific research in civilian products developed, the situation at our institute changed profoundly. The more visible change occurred in the improvement of our technical, production and management standards, in stimulating the enthusiasm of the workers to serve the motherland and in developing a good work style of conscientiously exploring the daring to create new things. We have transferred scientific research achievements and suitable technologies to the civilian sector, given internal support to the factories and enterprises to expand reproduction, created wealth for society, increased income, enlivened the economy, and promoted our own development. Over the past 2 years, we solicited funds on our own to build some urgently needed laboratories, added certain accessories which we lacked for the trial production line, and made up serious deficiencies in scientific research funds. We also improved collective welfare facilities and built dormitories and classrooms with our own funds. At the same time, we created a source for monetary awards for workers. Income increased, the workers' spirits rose, and manners and politeness became the new style of work.

(II)

As our main tasks in developing our institute's scientific research on civilian products, we made vigorous efforts to carry out the "three transfers" of scientific and technological achievements satisfactorily, to promote the growth of society and the economy and to improve scientific and technological standards. Thus we shortened the time of development of scientific research projects, and hastened the dissemination and application of scientific research achievements.

### 1. Develop Technological Superiority, Transfer Scientific Research Achievements and Provide Technical Services

To enable the techniques of scientific research to move from the laboratory to the realm of production, we transferred concrete scientific research achievements to the factories one after the other. The ZZF-5310 noncontract type displacement amplitude meter which was developed by our institute and which was cited and given an award by the National Science Conference, the DZY-1 multipurpose tachometer, the ZZF-6 six-channel vibration meter and the FD-7834 precise-frequency direct current converter, all of which had received provincial scientific technology awards, were transferred to the factories for production, which forcefully promoted the development of these enterprises. For example, the ZZF-5310 noncontact displacement amplitude meter can be widely used to measure vibration and displacement in steam turbines and water turbines. The technology is advanced, and the product is of superior quality and suited for the market. After production was transferred to the Hangzhou Automated Instruments Factory, it became a top-selling product of that factory. This scientific research achievement created over 3 million yuan in production value for this small factory which had over 120 workers and which could not even afford several hundred yuan for travel expenses. A factory was thus saved.

To develop the research institute's potential for trial production and to contribute to the national economy, our institute readjusted the product structure of the trail production line, enabled the trial production shop to increase its production of large quantities of scientific research products for civilian use, to carry out intermediate production tasks and to change the past situation of only providing test parts for the research laboratory. The tasks increased from the past situation of "not having enough" to "having too many." In the fact of heavy production and trial-production tasks, the production workers summoned up their energies, courageously shouldered the tasks, cooperated whole heartedly, worked overtime and worked at more locations. Because everyone dared to think and act and worked pragmatically, the trial production shop was able to guarantee the manufacture of military products and also was able to complete the manufacture of over a hundred units and sets in test production and small-lot production during the year. The designs of the scientific and technical personnel were quickly tested in practice and wealth was created for society.

To develop the strong points and potential of the technology, the experimental equipment and the means of testing at the research institute, we took the initiative, oriented ourselves toward production, boldly served,as technical consultants to factories, and helped factories overcome key problems in production. For example, Zhuzhou City's Switch Factory took up the task of trial-producing and processing a number of process control. Because its technical manpower was insufficient the products could not be tested and delivered. We took the initiative and sent engineering and technical personnel who have been involved in testing for many years to the factory to help test the products. To deal with problems in design, we changed part of the logic circuits and conducted laboratory simulation tests according to the designed requirements. These products met design specifications, and performance was stable. At the time the products left the factory, their design, function and construction were all satisfactory, and they also satisfied the urgent needs of the Gezhouba Dam project. Now, that factory regards our institute as its "technical backup," and it now dares to accept orders for manufacturing technically complicated electronic equipment. We also took the initiative in orienting ourselves toward the development of technical services on a broad basis in society. In recent years, we have conducted tests of a fuel oil regulator and the torque sensor for the Xiangjiang Machinery Plant, conducted tests of a pneumatic actuator mechanism for the Hangzhou Steam Turbine Plant, conducted blade regulator tests for Institute 703, and conducted tests of a torque measuring mechanism for the Xiangxi General Instruments Factory. This year, we have also trained experimental personnel in laser holographic photography equipment for 17 units within and outside the province, enabling them to grasp the principles and experimental techniques of that scientific research achievement. In recent years, we have inspected and repaired over 80 precision testing instruments for nearby city and county enterprises and business units so that instruments and meters that did not meet operating requirements could be restored to their original technical state and the quality of the products could be reliably guaranteed.

## 2. Transfer Military Products Technology Energetically, Hasten the Progress of Scientific Research on Civilian Products

Our institute has energetically transferred techniques used in the production of military products, including design, technological flow, the selection of materials, to scientific research on civilian products. For example, the automated bread production line developed for the Zhuzhou Bread Factory involved the large-scale use of a military scientific research achievement, the eddy current sensor, in measuring fluid materials, cutting and canning, and in synchronizing the main transmission for the automatic production line. This was simple, economical, practical and reliable. Military hydraulics technology was used in eight types of intermittent power equipment, including the power equipment of a rotary plate for continuous fermentation in the automatic production line, the pouring of flour from containers, automatic adding of powdered ingredients, stopping and release. This simplified mechanical structures and reduced electricity consumption. The technology of regulating an atomizer spray, developed for military products, was used for spraying oil inside pans. The uniform spray conserved oil. Because of the massive application of military technology, much redundant labor was eliminated, the time spent in scientific research was shortened, and the automated production line in food technology was completed in only 2 years. The work involved process studies, general layout, substantiation of plans, design, trial fabrication of equipment, installation, testing, trial production, product evaluation and delivery. Our efforts enabled the whole automated production line, involving 27 single machinery units and systems and 5 large control cabinets, to have unified mechanical operation and electronic procedural control of mixing materials, mixing flour, fermentation, cutting, making dough, forming, placing in pans, rising, baking, removing from pans, spraying oil, cooling, and packaging. We retained the good habit of always being as careful about quality in our test manufacturing work as in producing military products. The processing precision was high, there was less noise, operation was reliable, and only 13 people were required to supervise the operation. Each day, 7 1/2 tons of bread could be produced. Since installation, testing and the beginning of production, over 10 propaganda units throughout the nation have issued news reports and television reports on our nation's first automatic bread production line successfully developed by our institute. People in Australia have written to inquire about it, people have come from Nigeria to negotiate, it has been publicized in Hong Kong. Thus, it has attracted wide attention in our nation and abroad, and has been praised by large food preparation factories and higher agencies in our nation. Although unfamiliar with the bread manufacturing business, we were still able to make breakthroughs in it within a relatively short time and solve the problems of continuous automatic fermentation, automatic panning, automatic removal, continuous operation of the whole set of facilities and process control, which previously had been unsolved for a long period. We were able to do so with the help of various related sister units in the food industry, largely because of the concrete results of energetically applying military technology. At the same time, we applied speed testing techniques and vibration testing techniques developed for military products in the development of civilian or military and civilian instruments. In the course of about 3 years, we successfully developed 10 new testing instruments, and provided new equipment for high precision digital speed measurements of civilian rotary machinery, for rotary speed control, speed protection, and vibration monitoring. We are convinced that appropriate transplanting of military technology to scientific research for civilian products can yield good results by shortening the time for research and development, by producing more achievements, by popularizing and applying the achievements quickly, by producing good economic results.

### 3. Absorb Imported Technology, Combine Learning From Foreign Nations and Our Own Innovations

To transfer foreign technology into our nation, we have greatly strengthened technical information gathering. We have recommended foreign publications and information to technical personnel and absorbed advanced technology for our institute to use. For example, our institute's testing research laboratory learned of the technology of a Japanese eddy current meter and successfully developed the ZGY-2 axis tracer for the Northwest Industrial

University, thus helping that school provide a new testing instrument in the study of rotor dynamics. We referred to the experimental information of the Lewis aircraft power assembly developed by NASA in the United States and successfully developed a scanning multiple point steady stage gas pressure meter. This provided a new means of multiple-point steady-state pressure measurement for developing military and civilian industries. We are engaged in reverse-engineering design calculations and experimental research on several imported products to utilize their advantages and develop our own new products and are pre-studying the parts so as to put foreign objects to Chinese uses. In scientific research on civilian products, we joined factories and enterprises to study how to digest, absorb, develop and create imported equipment on the principle of "learning, using, improving, creating," The Hengdong Straw Mat Plant last year imported three kinds of prototype automatic mat weaving machines. The plant is a collective enterprise. Its technical manpower is limited. Making drawings and imitating products was very difficult. We took over the task of making drawings, improving designs and trial production in order to support light industry and to create foreign exchange. After understanding the design principles and production techniques, we cooperated closely with the factory; we changed an automatic machine that could weave mats with designs and redesigned it into an automatic yarn threading machine, improved imported equipment such as the raised design mat weaving machine by improving the straw picking mechanism, the fuel line, and the yarn-breaking stop mechanism. We increased the width and satisfied the user's requirements. At present, the redesigned yarn threading and mat weaving machine has been successfully test produced and has been handed over to the facotry for trial production. Other imported mat weaving machines that have been improved are being trial manufactured. They will be evaluated and inspected in May or June of this year. The success in redesigning the automatic mat weaving machines has enabled that factory to renovate its equipment and its products have become high-grade products. The plant director said with satisfaction: "With the automatic mat weaving machine, the products of our factory can step from the 1950's into the 1980's, and the sales channels of the products can enter the international market from the domestic market; this is like a tiger being given wings."

(III)

Our institute was able to make progress in efforts to carry out the "three transfers" satisfactorily in developing scientific research in civilian products and open up the situation as a result of strengthening and improving the party's leadership, changing the weak and lax situation in ideological and political work, implementing appropriate technical and economic policies, and greatly strengthening scientific research management.

1. We Continued To Deepen the Understanding of Combining Military and Civilian Endeavors, Realize the "Five Sames" and Help Each Other

National defense science research units must not only shoulder the glorious task of developing advanced weapons and equipment and strengthening national defense, but must also support factories in following the road of expanding reproduction by the intensive method and stimulate the development of the national economy. Thus we must firmly implement the policy of combining military and civilian endeavors while taking the military endeavors as the key. We must persist in taking into consideration both scientific research in military and civilian products, arrange things on an overall basis, and concretely realize the "five sames": including both military production and civilian production on the agenda of the party committee, including both in examining plans including both in promoting technical personnel, including both in designation of progressive and model workers, and including both in achievement awards. Two model workers were cited and given scientific research achievement awards after our institute successfully developed the automatic bread production line. Because our institute followed the "five sames" in organizing scientific research work, we enabled scientific research in civilian products to occupy an equally important position. The scientific and technical personnel and workers underwent training and testing in scientific research on civilian products and effectively expanded their range of knowledge, improved their technical standards and operating skills, and conversely, promoted the development of scientific research on military products so that military endeavors led civilian endeavors and the use of civilian endeavors promoted military endeavors. The measurements and drawings of military products imported by our institute were basically concluded in slightly over a year; testing, analysis and reverse engineering are being energetically pursued, and proving of the plans for redesigned models of new products and prestudying of new machinery have begun. Prestudy of advanced components has yielded achievements in stages, and speeding up and modernizing the testing equipment has given preliminary results. Breakthroughs have been made in these areas, and new precision testing instruments have been developed successfully and continuously. In 1981, we completed 30 major projects of scientific research on military products, and we recieved 8 awards for major scientific and technological achievements from the ministry. Experience proves that as long as we follow the spirit of the "five sames" in our guiding ideology of organizing scientific research work, we can prevent oversights, and realize mutual support and coordinated development of scientific research on military and civilian products, thus becoming able to shoulder the heavy burden of serving the national defense buildup while contributing to the development of the national economy.

### 2. Select Scientific Research Projects Involving the "Four Services," Develop Advantages and Avoid Shortcomings, Utilize Strong Points

Science and technology should develop in coordination with the economy and society, and their foremost task should be to promote economic and social development. Thus our scientific research unit must select civilian products closely related to the "four services" (serving the national defense buildup, serving the production of consumer products, serving technical improvement in the national economy, and serving export and the creation of foreign exchange) in the selection of scientific research subjects. All urgently needed projects that provide the "four services" must be carried out whether they produce a lot of benefits or few benefits, whether they earn large of small profits and whether or not they guarantee a return of the cost. We must take the initiative in sharing the burden of the state and make efforts in readjustment. Once our service orientation is straigthened out, we must persist in starting out from the actual situation, develop advantages and avoid shortcomings, develop superiority, and combine our own special skills and technical characteristics to develop fully the superiority of our own technology and the potential of the equipment before we can establish ourselves in an invincible position. We believe that the advantages of the research institute are that its academic disciplines are complete, its design strength is strong, and has fast access to technical information. Its shortcomings are its insufficient manufacturing strength, its incomplete high and low temperature technologies, and productive capabilities and management level unsuitable for large-scale production. To develop our own advantages and avoid our shortcomings, we must be courageous in taking up creative and exploratory developmental tasks related to the "four services," grasp the difficulties in weak areas, and gnaw at tough problems. The products developed in this way are urgently needed by society, and we will not have to worry that they will not have "in-laws" (markets). Since our institute focused on the "four services," our road has become wider because we have appropriately selected research subjects based on scientific forecasts. The economy has become more lively, and our scientific research tasks have changed from the past situation of "not enough" to the present situation of "more than enough."

### 3. Implement the Principle of Unified Planning and Responsibility at Each Level, Pool the Wisdom of Everyone To Fight a "People's War"

Scientific research work and tackling technical problems are like a revolutionary war: "battles can be fought only by mobilizing the masses, and only by relying on the masses." To mobilize the workers of the entire institute to involve themselves energetically in scientific research, we used various forms assigning tasks to the right places according to the amount of work, the specialities involved, the degree of complexitiy and the different economic benefits and in accordance with the principles of unified leadership, unified plans, assigning responsibility to each level, division of labor and cooperation in scientific research projects for civilian products. As a result, everyone knows the goals clearly, everyone knows what is involved, everyone dares to act freely and develop his talent, thus creating a situation in which everyone pools his wisdom and efforts to fight a "people's war" in scientific research in civilian products.

In the production of small commercial products, "each fought his own battle." We once organized the production of electric blankets and the making of work clothes under the guidance of the management idea that "while a large institute, we never regard any undertaking as too small." We distributed this work that produced only a little profit to the women workers of the institute, with responsibility for specified amounts of work. They satisfied the needs for internal supply and external sales at that time.

The scientific research projecta that could be carried out independently by the research laboratory were done by "each fighting his own battle." All subjects and projects in which technical difficulty was matched by developmental ability became the independent responsibility of the research laboratory, from the determination and drawing up of the research plan, to the determination of the specific design, testing, and the writing of the technical report. The laboratory fully developed the enthusiasm, initiative and creativity of its workers, and as a result, the period of development was short, less money was spent, the achievements quickly entered into production. For example, two of our institute's civilian-oriented scientific research achievements, the labor holographic photography device and the axis tracer, were developed by the material strength laboratory and the testing laboratory. We manufactured 15 units comprising 140 sets of the laser holographic photography device on a trial basis while finalizing the design. Subjects involving many disciplines have been carried out by several research laboratories "in coordinated combat." The entire automatic bread production line developed by our institute for the Zhuzhou City had to have a mechanical drive and to use electronic process control. We organized the second and fourth laboratories, which had stronger mechanical and electrical design manpower, to work jointly on the project. Because we concentrated superior forces to fight the battle to annihilate the enemy, we had to struggle for only 2 years to realize success.

Large and difficult scientific research tasks were carried out by organizing the entire institute to conduct a "large-unit battle." The problem of degumming of ramie worked on by our institute required continuous, mechanized, semiautomatic operation, from softening and combining of the raw ramie, to acid soaking, alkaline boiling, baking, dehydration, loosening, bleaching, drying, softening and winding. This was a key subject affecting the development of the whole nation's ramie textile industry. We removed the boundaries between units, organized people involved in the areas of general configuration, capabilities, structure, strength, and electrical devices into "five armies," to form the technical backbone teams of the research laboratory, and concentrated organization to tackle the problem, thus conducting a "three-dimensional battle."

Through the various methods above, we organized scientific and technical personnel not engaged in scientific research for military products or those with insufficient tasks and let them show their talent. We developed their full potential, channeled everyone's wisdom and talent into the revolutionary tide of producing civilian products and developing scientific research and, carried out a vigorous "people's war" in scientific research. The whole institute eliminated "dead areas" and basically eliminated "idlers." Scientific talent grew rapidly and scientific research achievements continued to emerge; this year, 19 important scientific research achievements are about to be evaluated and inspected. We are convinced that in the distribution of the planned scientific research tasks, we must liberate ideology, be free and daring, suit people to the situation, and arrange work in a flexible manner.

## 4. Actively Implement the Economic Responsibility System; Realize Distribution According to Work and More Income for More Work

The economic responsibility system implemented by the research institute is a system of managing scientific research by linking responsibilities, powers and benefits. It is centered around the goal of improving economic results and political responsibility under unified plans. In scientific research on civilian products, we established a strict responsibility system by clarifying the economic responsibility of the research laboratory, the trial production shop and the functional departments and offices to guarantee that all sides were in contact and were coordinated.

Units carrying out scientific research on civilian products mainly operate in terms of specified subjects, personnel, time and funds and guaranteed trial production followed by regular production. Monetary awards are evaluated and determined by the achievements evaluation group for all scientific research projects that have been inspected and accepted and whose data have been filed. Stage by stage awards are given for scientific research projects that are difficult and that require a long time, provided that certain major technical breakthroughs have been made. The implementation of the economic responsibility system stimulates the scientific and technical personnel conscientiously to prove the technical and economic value of every scientific research subject an analyze its technical standard. Value engineering management techniques are used, and efforts are exerted to reduce the cost of scientific research, to shorten the period of development, to reach technical maturity, to develop a feasible technology, and to achieve economic rationality and visible results, thus guaranteeing that every project in scientific research on civilian products undertaken by our institute is successful and is disseminated and applied.

Shops that manufacture civilian products on a trial basis operate mainly in terms of specified output, quality, rates of progress, and awards and penalties, and guaranteed delivery of the products. According to the size of the tasks, they contract work that generates little profit. All tasks completed ahead of schedule receive increased awards, and awards are withheld for all projects behind schedule. After the products are inspected, accepted and delivered, half of the output value is kept. The implementation of the economic responsibility system has stimulated the shops to use the best technological methods, establish advanced average quotas, pay attention to the quality of test production, improve productive efficiency; and hard work, tangible work, skillful work are maintained month after month.

Functional departments and offices carry out their assigned duties in management, material supply, and technical services. They guaranteed the front line of scientific research its needed funds, its supply of raw materials, fuel and power, and imported materials, as well as assuring coordination and continuation of the plans. To inspect the implementation of "four guarantees and one contract," we implemented annual plans, quarterly arrangements, and monthly evaluation and comparison. Departments and offices that completed the tasks well were given points and additional awards. The monthly awards for all scientific research and production tasks that were delayed through the fault of the functional departments and offices were withheld or decreased. The implementation of the economic responsibility system stimulated the relevant functional departments and offices to carry out effective comprehensive balancing and strengthen plan management, institute evaluation and review techniques for key projects, and organize smooth scientific research work, thus eliminating the past situation in which plans were not implemented, there were no inspection criteria and work was not coordinated.

Facts prove that linking together economic responsibility, economic results and economic benefits is a better way to improve scientific research management, work efficiency and economic benefits. Through the trial implementation of economic responsibility, we enabled the research laboratories, the special groups, the shops, the shifts, the departments and offices, and special personnel to become like lively economic cells. Political work was truly combined with scientific and technological tasks so that there was a more reliable guarantee of the scheduled completion of scientific research tasks and the implementation of scientific research contracts.

Although our institute has taken a great step forward in developing scientific research on civilian products, this is only the first step; and we are far behind in satisfying the requirements of the party and the state. In the future, we must follow the policy for scientific and technological work promulgated by the Central Committee, mobilize scientific and technical personnel and workers, and think of ways to realize the "three transfers" better in scientific research and technology, to truly improve scientific research management, and to increase development of scientific research in civilian products. In 1982, we are determined to mobilize the entire institute for a common struggle together, to work hard, to exert our full effort, to imitate the spirit of the women's volleyball team, to climb the heights, and to create new standards, realize new achievements, and make new contributions!

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CSO: 4008/212

# READJUSTMENT PROBLEMS IN METALLURGICAL RESEARCH DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 56-60

[Article by Wang Gang [3769 6921] of the Heilongjiang Provincial Metallurgical Research Institute: "Preliminary Exploration of Several Problems of Local Scientific Research in Metallurgy During the Period of Readjustment"]

[Text] Our nation's regional metallurgy was gradually formed and developed from local metallurgical industries during the latter part of the 1950's. Our nation's regional metallurgy consists mainly of medium and small steel and iron enterprises using a production method that combines Chinese traditional methods, indigenous methods and foreign methods. There is a visible local character. Therefore, our nation's regional scientific research in metallurgy oriented toward this type of method of production of steel and iron possesses characteristics in common with general metallurgical science and technology, and it also naturally possesses its own fixed characteristics.

At present, local scientific research agencies occupy a definite position in our nation's scientific research system. In the metallurgical system, local scientific research agencies have developed greatly over the past 20 years and more. At present, with the exception of the frontier provinces of Xizang, Qinghai and Ningxia, almost all provinces, cities and autonomous regions have established metallurgical research institutes or steel and iron research institutes. Also, some large provincial cities have also established corresponding research institutes.

For more than 20 years, the broad range of workers and scientific and technical personnel of local metallurgical science research agencies have overcome various difficulties and done much that is useful through hard work and under the guidance of the correct line of the party. They not only created local metallurgical science and research, they also expanded such efforts and gradually developed them. They have also done a great deal to support and stimulate the development of production by the local metallurgical industry. But, like local metallurgical industries, local scientific research in metallurgy was severely devastated during its development by the Cultural Revolution. With the addition of our lack of conscientious research in borrowing related experience from other nations, there are still many shortcomings in many aspects, even today. There are many problems that need furthere exploration and solution. I will discuss about my own opinions on some problems in scientific research in local metallurgy during the period of readjustment based on my experience of many years in scientific research andmy preliminary understanding of scientific research in local metallurgy.

## I. The Direction and Tasks in Scientific Research

1. The determination of the direction of scientific research is an important prerequisite for research institutes' scientific research work. It is a major problem that must be considered first and solved in building research institutes. It is very obvious that if the direction of scientific research of a research institute is not clear or is not fixed, then there will be unfavorable results in its development and its scientific research work. Abroad, this important question, which affects the success or failure of a research institute and even the fate of the enterprise, is handled very cautiously. For example, the direction of scientific research of the West German Production Research Institute and its key points of implementation are determined by a council consisting of leading members and the chairmen of all special committees of the German Steel and Iron Engineers Association. In our nation, the direction of scientific research of some large scientific research agencies, such as the Academy of Sciences or the research academies and institutes subordinate to the industrial departments is discussed by the academic committee and reviewed and determined by the party committee. But according to preliminary understanding, except for a few of the local scientific research agencies in metallurgy (such as Beijing, Tianjin, Shanghai), many local scientific research agencies in metallurgy do not have a clear direction in scientific research, or more specifically, the principles seem to be clear, but actually the direction is ambiguous. As a result, work is affected and the realization of achievements and the training of people suffer. We know that some local metallurgical research institutes have been established for several years, but their organization and the means of research are still incomplete and handicapped. The organization of scientific research personnel by specialty and level remained incomplete for a long time. Some scientific research work that needs to be undertaken could not be carried out. There are also some research institutes that have remained static for many years.

Our nation's policy of developing science and technolgoy mainly emphasizes applied research and developmental research, and especially emphasizes the strengthening of developmental research and developing technical services. According to the division of labor of the various research agencies of our nation's scientific research system, the Academy of Sciences and the higher educational institutions should be mainly involved in basic research and applied research (with emphasis on the basics) while the scientific research agencies of the industrial departments and the localities should be involved mainly in applied research and developmental research. Research institutes of enterprises should mainly emphasize developmental research. In the local metallurgical industry, medium and small enterprises generally do not have their own special research agencies while the central laboratories of the medium-sized enterprises and the laboratories of small enterprises generally cannot carry out research work except the daily task of inspecting products. In this respect our nation's situation is similar to that abroad. For example, most of the medium and small companies in France do not have research laboratories. Even under the best situation, they are limited to having only some inspection and testing groups. There are only a few enterprises that have first-class laboratories. Also, for example, the West German Government believes that it is too much of a waste for medium and small enterprises to establish their own research laboratories, and they do not have the means. On the other hand, there are no constant research tasks, and the difficulty of some research subjects cannot be overcome by the enterprises themselves. But these enterprises frequently must solve the problems that they encounter by scientific research; therefore, they must commission other departments to conduct research and development of special projects or conduct cooperative research. Therefore, we can conclude that local metallurgical research institutes possess at the same time the nature and functions of the research institutes of metallurgical enterprises. Therefore, they should mainly engage in applied research and developmental research with special emphasis on developmental research.

As local metallurgical research institutes, their direction of scientific research must also focus on local resources of metallic ores, the characteristics of the technical equipment and technological processes of local metallurgical enterprises, and the characteristics of market needs for local metals or the destination of the products of local metallurgical enterprises, and they must persist in serving production in local metallurgical factories and mines. To enable scientific research to lead production and to provide technical reserves for local metallurgical enterprises, the local metallurgical research institute must carry out research in metallurgical raw materials and in metals. Both are necessary.

2. The tasks of local scientific research agencies in metallurgy can be divided into near-term and long-term tasks after clarifying the direction of scientific research. Near-term tasks must center on the efforts of local metallurgical enterprises to develop potential, their efforts in renovation and improvement and their efforts to increase output and income, and the research tasks must adapt to the needs of enterprise readjustment.

It should be pointed out that most of the local metallurgical enterprises have backward production technologies, the equipment is outdated, the means of inspection and testing are very simple, the waste of energy is serious, and environmental protection work is very weak. As a result, the quality of the products is low, the cost is high, and output cannot be increased. Therefore, local scientific research agencies in metallurgy must face this reality and exert efforts to renovate production techniques, rebuild metallurgical equipment, improve the quality of the products, conserve energy, carry out comprehensive utilization, improve the environment, and improve testing techniques.

New materials, new techniques and new equipment are the three pillars of our scientific research in metallurgy. Therefore, when local metallurgical research institutes carry out the above tasks, they must also develop the dissemination and application of new technology and new techniques, test-produce or develop new materials, and pay attention to the study of comprehensive utilization of local resources.

Local scientific research agencies in metallurgy should especially emphasize renovation equipment. The neglect of equipment renovation is more serious in local metallurgical enterprises. On the one hand, the original equipment is outdated, and on the other hand, they have blindly copied and imitated; thus the funds for technical measures are being used year after year while the condition of the equipment have not visibly improved. This requires local scientific research agencies in metallurgy to strengthen studies in equipment renovation and to provide more effective technical services for the renovation of equipment of local metallurgical enterprises.

When determining the tasks, we should also consider expanding the clientele serviced. We must not serve only the local metallurgical enterprises; we can also directly shoulder the tasks of test-producing and developing metallic materials needed by such sectors as local light industry, the textile industry, the electronics industry and the building materials industry. We can seek ways for the local metallurgical enterprises to expand our service clientele outside the province and accept scientific research and test development tasks commissioned by sister provinces or the Ministry of the Metallurgical Industry.

## II. The Establishment of Research Agencies

The establishment of research agencies constitutes organizational support of scientific research development. Local scientific research in metallurgy lacks experience in establishing agencies adapted to the needs of such work, and there are no similar cases abroad for us to refer to. The Soviet Union has only two levels of scientific research agencies in metallurgy, the national agencies and the agencies belonging to the republics. Each level is divided into two categories, one belonging to the science academy system and the other belonging to the industrial sector. Metallurgical research institutes of major capitalist nations such as the United States, Japan and West Germany, can be generally divided into three types: those belonging to the national industrial sector, research agencies belonging to the higher educational institutions and those belonging to metallurgical enterprises. For example, the Metallurgical Research Center of the U.S. Bureau, mines the Metallurgical Research Institute of Japan's Tsusansho (International Trade and Industry Ministry) and West Germany's Special Research Agencies (such as the Max Planck Steel and Iron Research Institute) belong to the first category. Regional metallurgical research agencies like those in our nation can be said to be unique in the world. We need to explore the establishment of two-level agencies in terms of the present situation and development needs, the research institute itself and its internal departments.

1. On Establishing the Research Institute: The distribution of metal ore resources in each region is different. This creates an imbalance in the development of local metallurgical industries. Thus, the necessity of establishing local scientific research agencies in metallurgy is not consistent. Therefore, when considering establishment, we must suit measures to local circumstances. But the actual situation in each province, city and autonomous region at present is that almost every locality has established a metallurgical research institute, and some provinces also have two levels of research institutes belonging to the province and the cities. It is worth discussing whether this is necessary. Take Heilongjiang as an example. In 1972, it prepared for the establishment of the provincial metallurgical institute. After 7 years, when the provincial institute was still being built, Harbin City also built a metallurgical research institute. Now, the specialized organization and the caliber of personnel at the provincial metallurgical institute are still not complete. Although it has done some experimental research work during the course of development and it has realized some achievements, they are far from satisfying the demands for scientific research by the local metallurgical industry. The city's metallurgical institute has been established for 2 years, and it now has only 10-odd workers. It does not have a laboratory and means of testing, and up till now it could not carry out scientific research work. Such situations do not exist in the province of Heilongjiang alone. The reason for such overlapping agencies is related to our current management system. At the same time, it is also related to the long period of feudalist influences in our nation. Our view of this situation is that we should be determined to reorganize it during the period of readjustment. The first step can be to start out from the actual situation in each province, to take account of the historical situation, to select and keep those organizations with better conditions, and to concentrate the manpower, materials and finances of the province and the cities to operate such institutes competently. We must not engage in formalism, striving merely to have large numbers of such agencies, and putting up fronts without seeking actual results.

Because most scientific research agencies in metallurgy have a weak foundation, backward means and a weak technical staff, among other reasons, their development has been limited. In addition, in the provinces, generally speaking, the local metallurgical industry is not developed. To bring out advantages, compensate shortcomings and develop superiority, scientific research strength should be formed into a "strengthening force". We believe the second step can be to take the large area (or economic cooperation zone) as the unit, based on the actual situation in each locality, and to join the metallurgical research agencies of each locality within the zone to form a large area metallurgical research agency which will serve medium and small metallurgical enterprises within the large area. To facilitate work, we can consider placing large-area consolidated metallurgical research institute under the leadership of the Ministry of the Metallurgical Industry.

2. Establishment of the Internal Organization of Research Institutes. After clarifying the direction and tasks of scientific research, the research institutes must begin work with a specific organization, i.e., research

laboratories, testing laboratories and the subject groups. Therefore, the establishment of research agencies must correspond to and be coordinated with the directions and tasks of scientific research in order to promote the completion of research tasks and thus to realize the direction of scientific research. According to foreign experience, research institutes have three organizational forms: by academic discipline, by function, and composite organization.

The establishment of research organizations by discipline is relatively simple but the shortcoming is that when a complex research topic is encountered, the heads of each special research laboratory cannot shoulder the entire research responsibility; even when temporary coordination groups are organized under the sponsorship of the head of the research laboratory, it is still difficult for them to work in coordination and frequently, the director of the research institute has to push the work ahead. Therefore, other than the research institutes engaged in basic research and applied basic research, this organizational form is generally not used. (Most of the research institutes (such as the Metals Research Institute) of our nation's Academy of Sciences system use this organizational form.) Research organizations established by function have a definite flexibility in carrying out work and it is easy to organize researchers of different specialties into cooperative research groups according to plan. Management is relatively covenient, but the shortcoming is that redundant personnel and equipment are easily created. Those established by function can also be divided by product (such as alloy steel, high temperature alloys, precision alloys, refractory metals) and by production procedure (such as mining, ore classification, sintering, iron smelting, steel smelting, steel rolling). Most of the research academies and institutes of our nation's industrial sector use this organizational form. The so-called composite form involves the establishment of a unified technical service department (such as common laboratory) within the research institute. This form is the common trend in all nations. It can to a certain degree overcome the shortcoming of redundant personnel and equipment, and it can improve the work efficiency of scientific research personnel and the rate of utilization of equipment.

Local metallurgical research institutes generally divide their research laboratories by function. We believe that in the future, as work develops, they should gradually change toward the composite organizational form to centralize general means of testing and establish a unified technical service department or a common laboratory for use by all research laboratories and all groups of the whole institute. This is very beneficial for fully utilizing equipment, conserving capital, and developing scientific research potential. Foreign nations already have relatively advanced management methods in this aspect. They advocate common use of large instruments and equipment, and the key laboratories are opened to the public. For example, the Ames Research Center and the Fermi National Laboratory of the United States not only provide facilities for domestic scientific research personnel to perform experiments, but are also open to foreign scientists. But, currently, a lot of the experimental research equipment of the departments and units cannot be fully utilized because of irrational management systems. There is even one unit that has internal experimental equipment that cannot be used by everyone; it is left unused and others are not allowed to use it. This bad style of departmentalism is not compatible with the superiority of our socialist system. We should advocate large-scale cooperation, provide mutual assistance, establish special management for public use in the management system, and use surpluses to compensate deficiencies so as to utilize currently available experimental equipment fully.

## III. Dissemination and Utilization of Scientific Research Achievements

Scientific research achievements are the result of hard work of the mass of scientific and technical personnel. They are the precious wealth of mankind. They are the material foundations and the indispensable resources to build a modern and strong socialist nation.

Before scientific research achievements are disseminated and applied, they manifest themselves as a productive force only in the form of knowledge. They are potential and indirect productive forces. To convert them into practical and direct productive forces to satisfy social needs, we must conscientiously disseminate and apply them well.

Foreign nations place a lot of emphasis on the dissemination and application of scientific research achievements. For example, the U.S. Government and Congress both emphasize that scientific research achievements must be rapidly applied to realize economic results. Private American businesses take the initiative to establish broad and effective cooperation with the universities and research agencies in order to improve the competitive ability of the products and to seek maximum profit; thus scientific research, technological development, and production and use are tightly combined. The channels are not blocked, and scientific research achievements are rapidly applied. This is a very important factor that pushes the development of American social productivity ahead. A report by the International Development Association states that in the United States, about 80 to 85 percent of scientific research achievements are quickly used in production. Its heavy industry undergoes technological renovation an average of every 5 years. The rate of utilization of scientific research achievements in Britain, France and West Germany is 50 to 65 percent. In major capitalist nations, special management agencies have been set up to disseminate scientific research achievements. For example, the Steel Research Institute of U.S. Steel (USS) has set up an office for the dissemination of research achievements and for technological support. The West German Steel Association for the Promotion of Scientific Research in Steel in 1954 and 1966 respectively They are responsible for gathering, guaranteeing and economically evaluating the scientific research achievements of the committees and research institutes and disseminating them for production.

In our nation, the dissemination and application of scientific and technological achievements in production are still weak links. Many scientific and technical achievements are still at the stage of samples, exhibitional products and gifts, and they have not been popularized and applied. According to surveys, in our province, during the 10 years from 1969 to 1978, the scientific and technological achievements disseminated and applied in production constituted 47 percent of the total number of scientific and technological projects completed. There are also some scientific and technological achievements that have already been applied but have not established themselves, and the actual percentage of utilization is only about 30 percent. The percentage of experimental research achievements over the 9 years since the founding of our institute that have been disseminated and applied is only 29 percent.

Although there are many factors that affect the dissemination and utilization of local scientific research achievements in metallurgy, according to our experience, the principal ones are the following.

1. There are many gaps between metallurgical production and scientific research work. In the planning and management system, production plans and scientific research plans are managed separately by different administrative departments. And these administrative departments frequently "fight their own battles" and do not communicate with each other when drawing up or reviewing plans.

2. The current management method, policies and regulations frequently affect the dissemination and application of scientific and technological achievements. For example, the current price policy does not include the principle of demanding good prices for superior quality, thus when the enterprises utilize scientific research achievements, although the quality or performance of the products has been improved, the products cannot reap true benefits; therefore, the enterprises are unwilling to pay the price to utilize scientific research achievements. Two years ago, our institute took on the task of studying the classification of troilite ores within the province. As a result, the sulfur content of the superior quality fine raw material for the sulfuric acid plant and created the conditions for the comprehensive utilization of iron in sulfuric acid slag. But because the price policy was unreasonable, the work spent at the ore classification plant was not compensated for but was punished. This caused a loss and this scientific research achievement was not popularized and applied in production. The enterprises also did not realize any gain because they did not have this scientific research achievement.

3. The leaders of the enterprises and the economic departments still have a certain lack of understanding of scientific and technological work. They have not clearly understood ideologically the organic link between science and technology and production. The dissemination and application of scientific research achievements are comprehensive tasks with a very strong planned character. More manpower and materials are needed during this stage, and according to some statistics, the ratio of the funds required for research, development and popularization of achievements is 1:10:100. This shows that the price that has to be paid increases as research approaches the stage of material production. The present

situation is that although the applicationof one scientific research achievement may realize economic benefits worth several times, a dozen or so times and even several dozen times the investment in scientific research, leaders of some of our enterprises seem to be accustomed to in a passive production situation, and to be unwilling to spend the funds under their control for scientific research work.

4. The lack of intermediate means of testing, thus creating a gap between scientific research and production, is also one of the factors affecting the popularization and application of scientific research achievements. If an applied research achievement lacks complete and reliable test data, then even if achievements of intermediate stages are successful, they are still difficult to disseminate. Not doing things according to scientific research procedures and not carrying out intermediate tests, anxiously seeking success and blindly entering into industrial production frequently will not yeidl the expected results. On the contrary, serious waste of manpower and materials will result. There is much experience and many lessons in this regard. Local scientific research units in metallurgy frequently cannot establish intermediate means of testing in time during the course of development because of various reasons, or the intermediate testing agencies are not sound. All such units should establish and make sound the intermediate testing plaants (shops) as early as possible to stimulate the scientific research achievements of the units themselves so that the achievements can be quickly converted to practical productive forces.

In the long-range view, considering the establishment of joint organizations for scientific research and production to adapt to the needs of economic development is an effective way to overcome the gap between scientific research and production. In this regard, foreign nations have had more mature experiences a long time ago. Since the 1960's, the United States has established 115 joint companies for scientific research and production. The Soviet Union has established over 130 joint scientiric and productive entities. The local metallurgical research institutes that have better conditions can select related enterprises and designing departments for joint ventures and organize joint companies for scientific research and production so that they can become the regional centers of metallurgical science and technology. This direction of development should be carried out cautiously, deliberated on fully, and prepared for fully before implementation.

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CSO: 4008/212

# ROLE OF SCIENCE, TECHNOLOGY IN DEVELOPING LIGHT INDUSTRY STRESSED

Hangzhou ZHEJIANG RIBAO in Chinese 25 Sep 82 p 2

[Article by Huang Zhanglai [7806 1728 0171], Head of the Cixi County Second Light Industrial Bureau: "To Develop the Second Light Industry System, Science and Technology are the Key Link"]

[Text] In his report at the 12th Party Congress, comrade Hu Yaobang pointed out that the modernization of science and technology is a key link in our four modernizations, and put strategic emphasis on education and science in economic development. These theses are extremely accurate and are the policies guiding our country's economic construction. In the past, the carpenters of this system knew how to make desks, the weavers knew how to weave baskets, and the blacksmiths knew how to use their pliers--they were experienced masters. Now, in developing new products, we have to talk about electronics, atoms, molecules. It is impossible to not know science and technology. To bring about speed and results assure that "the second light industry system is not light and will benefit the country and the people," our second light industry system must firmly grasp the key link of modernization of science and technology.

Since the 3d Plenary Session of the party Central Committee, our country's second light industry system has developed relatively fast. Output value and profit last year increased were 95 and 58 percent higher respectively than in 1978. We estimate that five factories will make over 1 million yuan of profit this year, which will be more than half of the profit made in the entire system. One major reason why these five factories have been able to take off is that they have been given the wings of science and technology. For instance, the Cixi sealing materials factory's predecessor was a plastic factory that was formed from three handicraft cooperatives making clothes, wooden bed frames strung with coir ropes and hardware, and was which formerly involved in producing containers for chemical fertilizers. In early 1979, because containers were unmarketable, it looked for a way out, and cooperated with Zhejiang University, the General-Purpose Machinery Research Institute of the former First Ministry of Machinery Building, Research and Design Institute of the Third Ministry of Machinery Building, and school and 11 institutes under the Seventh Ministry of Ministry Building, and the Shanghai Minxing Electrical Generating Plant and the Shanghai Oil Refinery. They used half a year's time to develop a new sealing material, expanded graphite, that can be used in the petrochemical, machine building, electrical power, metallurgical, chemical fiber, dyeing, electronics and space craft departments, and did a better job in solving the leakage problems in engines, pumps, pipes and valves in these units. After a nationwide technical appraisal, this scientific research result is at an advanced level domestically and the major technical index is near the international advanced level; it was awarded a provincial Class 2 award for scientific research results. Now, more than 1,670 varieties of this product are sold to over 700 units in the 27 provinces, municipalities and autonomous regions throughout the country; they are beginning to be sold to Japan. Experience shows that enterprises that are active in adopting new skills, new equipment, new techniques and new materials and in bringing forth new products develop fast, obtain good economic results and make major contributions to the country. Otherwise, the results will be just the opposite. Up to the end of August this year, the number of money-losing enterprises and the amount of money lost in our country's second light industrial system were the hightest in the entire district. A major reason is that there are still quite a few "four old" enterprises in the county. For example, the ironwork cooperative and carpentry cooperative in the past did one peice of work and counted one piece of work, and they could still make a profit. Now, there are fixed wages, meal subsidies and retirement expenses. The burden is becoming heavier and the expenses are becoming larger. Using the old methods to produce the old products, the organizations that do best will only break even, while those that do less well will lose money, and the workers will not get paid, and will need tax exemptions and welfare to get by. At present, most of the old carpentry cooperatives in the country are going to suffer losses. But the woodwork and furniture factory, as a result of reform in technology and equipment, has realized semi-mechanized production and has modernized the designs of the old products, thereby obtaining a profit of 114,000 yuan by the end of August this year. This is proof of our assertion.

The 12th Party Congress has set the great strategic objectives for our country's economic construction and has greatly inspired us. It has also greatly increased our sense of urgency in closely integrating science and technology with the production in the second light industry system. A thousand-li trip begins with the first step. Achieving the great goals of economic development in our country in the next 20 years requires that everyone work in the here and now. In order to better arm the second light industry system with science and technology, the bureau has already formulated a preliminary plan. The first point is to create within the entire system an atmosphere of learning and using science and technology, and to pay special attention to making full use of intellectuals and scientific and technical personnel. The second point is to strengthen scientific and technical work, gradually set up separate scientific and technical sections in the bureau and all the enterprises that have the means to do so. The third point is to continue to do a good job of cooperation with relevant education and scientific research units, and to hire specialists as advisors. The fourth point is to make an energetic effort to train and use scientifically and technically able personnel.

Enterprises that have the means to do so should send their staff members and workers to institutions of higher learning to undergo professional training and also should pay attention to selecting and absorbing able personnel who have special talents from society. Lastly, it is necessary to conduct effective sparetime education of staff members and workers, conduct cultural assessments of young staff members and workers and those who are in the prime of life, and raise their cultural and technical levels in order to meet the needs of the new situation. Recently, our bureau convened a special educational meeting for staff members and workers; it has organized a group of 68 deputy plant directors for technical matters and technicians to conduct an all-round large-scale quality inspection of 48 enterprises in four different industries in this system.

9335
CSO: 4008/12

## TASKS OF S&T WORK IN MEDIUM-SIZE, SMALL CITIES OUTLINED

HK130611 Wuhan Hubei Provincial Service in Mandarin 1100 GMT 12 Oct 82

[Text] The first national meeting on scientific and technological work in medium-size and small cities held in Xiangfan City for 7 days closed yesterday. Fang Yi, member of the Political Bureau of the CPC Central Committee, state councilor and minister of the state scientific and technological commission, delivered an opening speech and attended the meeting from beginning to end. Representatives from 16 cities, including the representative from Shashi City of our province, introduced their experiences at the meeting. The meeting affirmed the experience gained in carrying out scientific and technological work in medium-size and small cities. This is mainly: 1) effective leadership by municipal party committees and municipal governments is a fundamental guarantee for doing a good job in urban scientific work; 2) the major orientation of scientific and technological work in medium-size and small cities is to serve local economic and social construction, to serve people's production and livelihood and to make contributions to technical transformation of the national economy, and the improvement of economic results and the rationalization of economic structure. The major tasks of the scientific work in medium-size and small cities are to energetically develop production technology and new products and to promote the upgrading of products, improve quality and increase quantity, lower the consumption of energy and raw materials and raise productivity, so as to promote production; 3) energetically do a good job in shifting science and technology; 4) organize the existing scientific and technological strength and strengthen cooperation; 5) broadly open ways for seeking able persons and bring their role into full play; 6) broadly open channels for seeking more funds for the scientific and technological work; 7) give full play to the role of municipal scientific and technological commissions.

Zhao Dongwan, vice minister of the State Scientific and Technological Commission, made the concluding speech at the meeting. He pointed out: the spirit of the 12th CPC National Congress must be implemented in the scientific and technological work in medium-size and small cities. Party's principles and policies concerning the development of science and technology must continue to be carried out, so that science and technology can better serve economic and social development. We must strive to realize the objective issued at the 12th CPC National Congress and to quadruple the total annual value of industrial and agricultural production by the end of this century.

The meeting demanded that medium-size and small cities should mainly handle the following scientific and technological work: drawing up programs for the development of science and technology; choosing priority areas and key projects; organizing cooperation and settling key problems; and making actual contributions to technical transformation of the enterprises. It is necessary to strengthen the study of policies concerning science and technology and management work. It is necessary to earnestly carry out investigation and study and improve work methods.

CSO: 4008/37

## BRIEFS

SCIENCE, TECHNOLOGY FORUM--At the national conference on scientific and technological work in medium-sized and small cities, on 5 October Comrade Han Ningfu, second secretary of the Hubei Provincial CPC Committee, spoke, pointing out that it is necessary to grasp Hubei Province's future scientific and technological work in five respects: 1. It is necessary to vigorously stress the popularization of the scientific and technological achievements so as to make more scientific and technological achievements become a direct productive force. 2. It is essential to conduct organization, strengthen cooperation and tackle key problems in science and technology. 3. It is imperative to establish all kinds of combined scientific research and production bodies and put them on a sound basis to promote the development of scientific research and production. 4. We must continue to emphasize the training of people of ability to embark on scientific and technological work. 5. We must further strengthen leadership over scientific and technological work. [Text] [HK081416 Wuhan Hubei Provincial Service in Mandarin 1100 GMT 8 Oct 82]

CSO: 4008/37

## RESEARCH INSTITUTE DESCRIBES WORK IN SUPPORT OF LOCAL ECONOMY

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 35-37, 55

[Article by Wu Tingman [1566 1694 3341] and Jin Xiaoyin [6855 1321 6892] of the Shanghai Silicates Research Institute of the Chinese Academy of Sciences: "Serving Local Economic Construction in Accordance with Our Institute's Characteristics"]

[Text] Our institute is a material sciences research institute subordinate to the Chinese Academy of Sciences. We mainly study artificial monocrystals, special purpose glass, porcelains used in electronics, high temperature structural porcelains, and inorganic coatings. The study of these new types of inorganic materials is closely related to the economic development of Shanghai. In accordance with the academic direction and the technical advantages of our institute we have fully developed our potential in order to serve local economic construction. Below we briefly report on some work in serving the locality.

### I. We Have Actively Shouldered Local Scientific Research Tasks and Trial Production Tasks

Although we are a research institute of the Chinese Academy of Sciences, the Shanghai City Scientific Committee and various sectors have given us a lot of support and help. The city's conditions for cooperation and support are good. They are favorable to the development of scientific research. These have all encouraged and stimulated us to strive to complete the scientific research tasks handed down to us by the state, and to actively shoulder local scientific research tasks. Over the years, we have taken the initiative and have actively carried out some of the scientific research tasks of Shanghai's major comprehensive scientific research projects, such as project 7,112, project 728, project 708, and the optical fiber communications project. We have striven to contribute more to the locality.

Optical fiber communications is a new technology that emerged at the beginning of the 1970's. The city scientific committee organized several dozen units throughout the city to hasteh the breakthrough in this major scientific research project in order to develop modern communications. We actively participated in the Shanghai task force and took the initiative in shouldering the task of studying optical fibers. Because this subject is difficult and multidisciplinary and the schedule was tight, we organized interdisciplinary scientific research cooperation centered around Research Laboratory No 3 and fully utilized favorable conditions within the institute, improved efficiency in scientific research, hastened progress, and in 1977, successfully developed the phosphorous-silicon series of quartz optical fibers, developed the short-wavelength, low-loss wide-band phosphorous-silicon series short-wavelength, low-loss wide band. Under the leadership and organization of the city scientific committee and the optical fiber office, we established a cooperative relationships in scientific research and production with the Shanghai Xinhu Glass Plant in the 2d year. With cooperation and mutual respect, we launched a competition in technology and smoothly handed over scientific research achievements in phases to the factory for tests and production. The factory spent only 7 months trial-producing a certain quantity of satisfaction optical fibers, providing the optical fibers for laying the first 1.8-kilometer long optical communications cable in the city of Shanghai. The facotry spent only 2 1/2 years to reach the batch production level and thus contributed to our nation's optical fiber communications. Last year, we began the second phase study of the phosphorous-germanium-silicon series multiple-mode long wavelength optical fiber.

In addition, many difficult problems referred by the factories were also solved. For example: The electrical resistors manufactured by such units as the Shanghai Electrical Resistors Plant required a type of electrical insulation coating that can resist temperatures of 350±40°C. They originally used toxic enamel containing about 50 percent lead. This polluted the environment and seriously affected the health of production workers. At the beginning of last year, the factory presented the subject to us hoping that the coating could be replaced by a nontoxic coating. Comrades of our institute's heat treated paints group actively shouldered the task of quickly solving the problem in production. During the first half of last year, it developed two types of nontoxic coatings. One was the baked PA-6 coating suitable for use on non-pot type rheostats. The electrical resistance was greater than $10^{12}$ ohms and it met the required specifications. The other was the leadless enamel $R_9$. Experiments prove that it can replace leaded enamel. After improvements during the second half of the year, it will have even broader uses. In 1980, the Shanghai Boiler Plant presented us with the task of developing a protective paint for surface annealing (650°C) in fine processing of large products. Although the paint originally used by that plant did serve a protective function, after treatment, the coating was difficult to remove. If mechanical methods such as spraying sand were used, the fine processed surface would be destroyed. We exerted efforts in excess of the plan to develop a type of paint for that plant. After annealing, the coating could be removed with water. This satisfactorily solved the difficulty of that plant in production.

## II. Combine the Long-term and the Near-term To Contribute to the Development of the Present National Economy

According to the founding guidelines of the Chinese Academy of Sciences and the goals of our institute, we must study and develop materials science and continue to improve the academic standard in research work, and we must also serve the national economy and national defense buildup. Statistics of the research subjects of our institute during recent years show that about 48 percent of the research subjects are internation state-of-the-art work, about 10 percent are subjects in basic theory, and 40 percent are developmental research. Some of them are near-term work. The above ratios indicate that basic research in our institute does not constitute a large percentage and this needs gradually to be strengthened. We are creating conditions and actively encouraging those scientific and technical personnel with a firm foundation, higher foreign language capability and who are more interested in theoretical work steadily to develop research in basic theory when the conditions ripen. When arranging long-term exploratory scientific research work, we organized some scientific and technical personnel to conduct social surveys and market surveys, and we lined up some key technical problems that urgently have needed to be solved in the national economy in recent years to combine long-term and the short-term endeavors. For example, the study of noncrystalline semiconductor materials and devices is a relatively difficult and important problem that is being actively studied internationally. Our institute has already studied this for many years. We have paid attention to the study of physical and chemical processes in the gas-phase formation of glass films of noncrystalline semiconductor materials, the composition of the gas phase, the structural system of the film, and basic studies of the electron transmission characteristics of photoelectric conducting materials. We also paid attention to the study and development of such materials for short-term applications. The comrades of that group established the short-term goal of applied research in static-electricity photocopying through surveys and analysis of the domestic and foreign situation. The copying machine is widely used in foreign nations. The quantity produced is also large. For example, Japan manufactures 680,000 units a year. The annual amount of sales in the international market reaches over $10 million. Our nation is still relatively behind in this aspect. We produce only over 2,000 units a year. The whole nation has just over 5,000 units. Also, the quality of domestically produced copiers is not stable enough. The drum is the heart of the copier. How to improve the sensitivity and the life of the drum is a key problem in present production. In September 1980, our institute signed a cooperation agreement with the Shanghai Copier Plant to improve the life of the drum. We helped the factory establish the technological flow line for the synthesis of glass and selected eight kinds of sulfur series glass preparations. We conducted photoelectric conductance tests, differential thermal analysis, optical spectrum analysis, hardness tests and other physical performance tests for the film and the test materials, as well as chemical composition analysis. We plated a total of 55 drums. The drums operated well. It was universally concluded that the sensitivity of the new sulphur series noncrystalline drum was higher than the pure drum by one or two times. The sueful life was at least 15,000 cycles, with highs over 45,000 cycles. The life of the original drum was below 10,000 cycles. After the film coating techniques are further stabilized, we hope gradually to begin production in the shop within the year.

## III. Transfer of Military Scientific Research to Scientific Research for Civilian Applications

During the 1960's and the beginning of the 1970's, many of the tasks of our institute came from the National Defense Science Committee and the National Defense Industry Office system. During the latter part of the 1970's, as the national economy was readjusted, the number of research subjects in military science was gradually reduced, and we transferred such military subjects to civilian use. Take the inorganic coating research laboratory as an example. Originally, over 90 percent of the work of that laboratory was involved in the study of new materials needed in national defense and the military industry. After readjustment, at present, over 54 percent of the work involves scientific research for civilian use. In the winter of 1974, we began the study of far infrared heating techniques. We used the technical equipment and testing equipment established for military scientific research and this research work progressed relatively quickly. We spent only 3 years to develop and produce successfully the three techniques of coating with paints, electric arc plasma jet spraying and enamel smelting and over 20 types of coatings. At the same time, we also successfully developed a far infrared heater, drying equipment and medium temperature total normally incident radiation testing equipment. The varieties were complete and the applications were broad. These coatings have already been popularized and produced by the Shanghai Changzheng Farm Coatings Plant and two plants in Jiangsu Province. With the common efforts of many scientific research units and factories throughout the city, Shanghai now has over 30 industries and about 4,000 units that use this new technique. Each year, they conserve about 200 million kilowatt-hours of electricity.

In addition, the plasma jet coating group, originally involved mainly in military scientific research, has also shifted toward mainly civilian scientific research in recent years. Research in coatings for the probes used in steel-industry water-bound oxygen determinatives, cathode catalytic coats for electrolysis of caustic soda, and coatings for artificial joints has realized definite achievements, especially a sprayed chromium oxide heat resistant coating that has already been popularized and produced by such units as the machinery repair plant of the Jinshan Petrochemical Combine in Shanghai. Visible economic reslts have been obtained. The plant originally had to import from Japan the sealing washers for end-facing machinery for chemical industry pumps. Now they do not have to be imported. Since 1976 when trial production began, the plant has saved a total of over 500,000-yuan. The value of the coating described above constituted about one-seventh of the total value.

Based on the requirements proposed by the factories in production, we began studying high strength acid and alkaline resistance enamel last year; we have realized visible achievements. We have test-produced it at the Fengbin Joint-Management Factory of Shanghai Enamel Factory No 1. This type of enamel not only satisfies the technical requirements for industrial enamel in production, its tolerance to acid is 7 to 8 times better than the standards issued by the ministry while the tolerance to alkalies is 2 to 3 times better. AFter 3 hours of alkaline corrosion, the enamel does not continue to corrode anymore. This type of enamel is more ideal than the industrial enamel 8 currently in use. It is a good acid-tolerant and alkaline-tolerant enamel.

## IV. Scientific Research Must Also Actively Contribute to the Improvement of the People's Standard of Living

Everyone knows that at present, the diseases that pose the greatest threat to human life and that have the highest death rate are heart disease, cardiovascular diseases and various types of cancer. To protect the people's health and prolong human life, we should primarily engage in preventive medicine and think of ways to diagnose early various types of heart diseases, cardiovascular diseases, cancer of the liver, and tumors of the stomach. The most effective diagnostic method abroad is the use of ultrasonic imagining. Our nation is still backward in this technique. To change rapidly the backwardness in medical diagnosis in our nation, we cooperated with the Sixth Hospital to develop a medical ultrasonic focus probe and a 64-head ultrasonic discontinuity plane imaging transducer. After over 2 years of exploration, the focusing probe has reached the standard of the same types of foreign instruments. It is suitable for various types of domestically manufactured cardiograms and B-type ultrasonic imaging machines, and it is also suitable for the cardiographs imported from Japan. This type of probe has already been clinically applied by the Sixth Hospital, the Zhongshan Hospital athe chest hospital and similar units. The Changhai Hospital used it with the domestically produced ultrasonic imaging machine to diagnose various types of pathological changes in cancer of the liver, the gall bladder, and kidney and stomach tumors. After more than 1 year of application, the results have been good, the performance has been superior, and it has coincided with the requirements of clinical diagnosis. To popularize it rapidly and satisfy the needs of more factories and hospitals, we test-produced over 600 units. The Sixth Hospital test-manufactured over 500 probes and provided them to the Shanghai Medical Electronics Instrument Plant and the city's hospitals for use. The cooperative research in the 64-head ultrasonic discontinuity image transducer also progressed and has approached the stage for practical application.

In addition, we have also provided various types of ultrasonic piezoelectric components to the Donghai Station and the Wuhan Radio Research Institute. And we have popularized this type of piezoelectric porcelain at the Shanghai General Toy Factory, to be produced by its first branch factory. After more than 2 years of effort, it can now be mass-produced and is being supplied to over 30 units throughout the nation for use.

Because the living standard of the people has continued to improve, the need for television sets has become greater. In recent years, we successfully developed the acoustic surface wave filter that can be used on color television sets. The main performance specifications reach the level of the Toshiba products of Japan. This wave filter has replaced the 6 yo 7 medium cycle wave filters in the original circuits. It eliminates complicated testing and facilitates integration. Last year, it was popularized at two radio plants in Shanghai and two radio factories elsewhere for production. At present, some factories are studying and readjusting the circuits to prepare for its use on black and white television sets.

According to the requirements presented by the factories, we studied glass for black and white television tubes from the beginning of 1976 to the beginning of 1979. With the active cooperation and support of many factories in Shanghai, we quickly completed the study of the S-2 formula for the glass of black and white tubes and its technology. This formula does not contain lithium or fluoride; it can conserve expensive lithium carbonate raw materials, and it avoids fluoride pollution and poisoning by the electron gun. In 1979, concerned factories in Shanghai used this formula and technique in production. Annual output reached 500,000 glass housings; in 1980 it reached over 600,000 glass housings. Comrades of the No 7 Shanghai Electron Tube Plant said that when this scientific research achievement was used, the quality of products and the percentage of satisfactory products improved. When combined with other related measures, that factory changed losses into profits and at the same time considerably improved the life of the black and white television tube.

Although we have done some work for local economic construction, we are still far behind in satisfying the demands of social and economic development in Shanghai. We have seldom visited the production facilities to seek for problems. The number of projects that have been popularized in production in Shanghai is still small. Analytic and testing techniques still cannot satisfy the requirements of sister units. Scientific research potential is still not fully developed. The efficiency in scientific research is still not high enough. Some research projects take a long time. Technical help and technical consultation for specialized factories producing marketable products are poor. We are determined to conscientiously improve the style of work and to serve local economic buildup better.

9296
CSO: 4008/212

# TECHNICAL COOPERATION BETWEEN LOCALITIES PROMOTED

Beijing RENMIN RIBAO in Chinese 15 Oct 82 p 2

[Article by Men Jinru [7024 2516 1172]: "Do a Good Job in Technical Cooperation Between Localities and Promote Technical Progress"]

[Text] The 12th Party Congress proposed that for the two decades between 1981 and the end of this century, while steadily working for more and better results, we must quadruple gross industrial and agricultural output value. An important aspect of realizing this strategic objective is the continuous development of science and technology. Experience over the past few years has proved that doing a good job in technical cooperation between localities is an important way of promoting technical progress.

Technical cooperation between localities means that localities and enterprises that are economically more advanced offer technical support to backward localities and enterprises in technology, production management and equipment improvement as well as in raising product quality and developing product variety. This support will not be given gratis. The localities and enterprises that receive support will render corresponding economic compensation. Cooperation is carried out voluntarily by both sides, thereby yielding benefits for both sides.

Technical cooperation between localities has played a clear role in promoting technical progress and working for more and better economic results. Since 1980, Yunnan Province and fraternal provinces and municipalities signed contracts of cooperation for 178 technical projects. The fulfilied contracts have shown that the results are good. For instance, with the assistance of Shanghai Municipality, Yunnan's manufacture of 1st grade polyester fiber was raised from 16. percent to 57 percent, and the color variation in polyester fiber printing and dyeing was raised from 3d and 4th grades to 4th and 5th grades. With the assistance of Jiangsu Province, the Kunming Chemical Fertilizer Plant lowered its production cost for every ton of ammonium carbonate from 173 yuan to 139 yuan, and shed the label of money-loser which it had had for 13 consecutive years. Also, for instance, with the assistance of the Shanghai No. 3 Sewing Machine Plant, the Luoyang Sewing Machine Plant in Henan improved its technology and after a year tripled its monthly output, changing its condition from suffering an annual loss of 400,000 to 500,000 yuan to making an annual profit of 400,000 to 500,000 yuan. The development in production and the improved economic results have fully reflected the technical progress that has been made. Compared with the usual type of adoption of foreign advanced experiences, technical cooperation can attain practical results more easily. Technical cooperation is launched by having advanced enterprises pay specific attention to the major problems of the backward enterprises in production, formulating the needed technical measures and signing contracts to render support. For instance, in supporting the Guiyang Thermos Flask Factory, the Guanghua Glassware Factory in Wuhu focused primarily on the key problem of low yield in semi-finished products, and adopted such technical measures as lowering the operating platform of the material-feed machine and the bottle-blowing machine, widening the mouth of the funnel, hightening the dropper and elevating the material surface, thereby raising the upt-to-standard rate of the semi-finished products from 30 percent to 70 percent and changing the production outlook of the enterprise. In technical cooperation, the backward enterprises can also adopt the method of asking people to come in and sending people out in order to train staff members and workers and raise the level of technical operation. Generally, technical cooperation is carried out as follows: The advanced enterprise first sends someone to the enterprise in need of support to understand the situation, find out the problem and assess the possibility of cooperation. If it is possible, then a contract will be signed with the enterprise in need of support and a body of management cadres, technical personnel and workers will be organized to go to the enterprise in need of support, where it will assist in management and practical operation and also train staff members and workers. After results in production have been obtained, the staff members and workers of the factory in need of support will be allowed to carry out production independently until production is stabilized. This is what makes technical cooperation superior to the usual type of adoption of advanced experiences and why it is easier to rapidly obtain economic results.

Our country is large and the development of the economy and technology of various localities is extremely uneven. There is a great deal of discrepancy in the level of culture and education and the development of mental resources in coastla districts, minority nationalities and border areas. As a result, our country's technical progress is necessarily multi-leveled. Technical cooperation between localities is an important measure in promoting the technical progress of backward localities and exploring economic results. We must be fully aware of its importance and significance to technical progress throughout the country and conscientiously do well at this important task.

In the previous period, technical cooperation between localities was usually done at will and was not connected with the state plan. In order to allow the technical cooperation between localities to develop steadily and healthily, we must include it in the state plan. In accordance with the guidance and demand of the state plan, we must support the reasonable aspects and take administrative measures to intervene in the unreasonable aspects so as to guarantee its development in the proper direction. At present, the emphasis in technical cooperation should be placed on exploiting and conserving energy resources and lowering raw materials consumption. It must be particularly borne in mind that we must not blindly expand general processing capacity. In technical cooperation, there will be all kinds of problems and contradictions among the various economic components, between supply and demand of raw materials and fuel, and between production and sale. These should be coordinated and resolved under the guidance of the state plan.

The "technical blockade" is a major obstacle to technical cooperation. Some enterprises have expended great effort and a great deal of labor to gain advanced technology and experience, and have not gotten what they have easily. They feel that if they hand to others their "knack" and "unique skill," then their products will lose their competitive capacity on the market. Such a worry is understandable. Nevertheless, under our socialist system, the relationship between localities and enterprises is a comradely relationship of mutual assistance and cooperation. We should not carry out "technical blockades" against each other. Of course, we should adopt proper policies and measures and take into consideration the interests of the advanced localities and enterprises. For instance, in technical support, the localities and enterprises in need of support should render equivalent compensation to the other party. Also, the specialized techniques of a very few enterprises should be allowed to be kept private and not disseminated for the time being.

9335
CSO: 4008/12

## DEVELOPING THE ROLE OF SCIENCE AND TECHNOLOGY IN AGRICULTURAL PRODUCTION

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No 4, Oct 82 pp 59-62

[Article by Zhang Penghui [1728 7720 5057] and Xiao Zuliang [5135 4371 5328] of the Henan Provincial Science Committee: "Several Questions in Scientific and Technological Work After Implementing the Responsibility System in Agricultural Production"]

[Text] After the Third Plenum of the 11th Party Congress and especially after the Sixth Plenum, the responsibility system in agricultural production was widely implemented in the extensive rural areas of Henan. Under the prerequisite of not changing the ownership system, such responsibility systems included contracting work to specialists, linking remuneration to production, contracting production to the families, thus greatly mobilizing the productive enthusiasm of the broad number of farmers, and forcefully promoted the development of agricultural production, and on the basis of developing production, the living standards of the farmers improved. Some farmers described this good situation as follows: "The clock cannot move people, but policy mobilized enthusiasm," "a horse is tethered in front of the door, new tiles cover the roof, we have enough to eat, our clothes are warm, we have money to spend," "red yams are replaced by white steamed buns, bachelors get married."

After implementing the production responsibility system in the countryside, agricultural production teams changed from the original production units to management units, and every farming family changed from a single living unit to both a living unit and a production unit. This change has created many new situations and new problems in all aspects. In scientific and technical work, the following problems should attract our attention.

I. Some farmers, especially young farmers, do not know how to plant scientifically, they urgently need to learn agricultural science and technology. According to analysis conducted by the Leichang Brigade of Huiting Commune in Xiayi County, this brigade had 930 full and half laborers, 21 of them understood agricultural techniques and 142 of them knew something about agricultural techniques, and 767 of them had no knowledge of agriculture. Some farmers deeply realized that now, farmers have three difficulties: It is difficult to plant without understanding techniques; it is difficult to increase output without superior seeds; it is difficult to buy chemical fertilizers and farm chemicals. There are also some farmers who analyzed the causes that have created such a situation: "After eating from the big pot for many years, work follows the whims of the brigade leader. Now that the responsibility system is implemented, without techniques one has to work until he sweats." To increase agricultural output and to increase income, the enthusiasm of the broad number of farmers to learn techniques has surged to an unprecedented height, the authority and the position of agricultural technicians has risen to an unprecedented height among the broad number of farmers. The broad number of farmers actively want technical contracts, rush to buy books on agricultural techniques, seek technical information, go everywhere to find teachers and visit friends, discuss scientific planting on all occasions, actively participate in various types technical learning. Now, technical cadres in agriculture "are followed by a crowd when they go to the villages. When they return, the crowd follows and breaks the gate, when they go to the villages they cannot come back, and when they come back they cannot leave." The Longtang Commune in Minquan County held a short term training class in agricultural technology for 50 people. The masses who willingly went to listen as auditors numbered several hundred people, forcing the class to move to a large classroom.

II. The original scientific research organizations have been shattered, new scientific research organizations have just emerged, and they need to be perfected and matched. The agricultural departments have surveyed and analyzed the situation. They showed that of the original fourth level agricultural science network, 80 percent have already lost their function. According to statistics compiled for four counties in Anyang Prefecture, the original scientific research team had 1,224 people, now only 106 are left, constituting 8.5 percent. As the responsibility system is perfected, scientific research stations of some production teams were reinstated after collapsing. Fanxiang Commune in Changyuan County was like this. It originally had 46 scientific research teams. After implementing the responsibility system, they were reduced to 4 teams, now they have developed to 22. But the method of contracting work and the method of distribution of the scientific research teams have fundamentally changed from eating from the big pot in the past to contracting specialized work and linking production to remuneration. To guide the development of scientific research activities in farm villages, the three administrative levels of the province, the prefecture and the county have all established some scientific research bases (in some areas they are called scientific research stations). The whole province has over 2,000 of them. The provincial science association alone has established 107 agricultural scientific research bases in 80 counties.

III. As autonomy in planting expands, mixing and degeneration of plant varieties will emerge. This problem is still not obvious now, but as time passes, the problem will become more outstanding. According to analysis by agricultural experts, superior varieties contribute 20 percent ot the increase in agricultural output. With the same soil quality and water conservancy conditions, the difference in quality of seeds produces different yields. For example, pure seeds bred from the zeng dan No. 2 hybrid corn seeds can produce a per mu yield of over 900 jin, impure seeds can produce a per mu yield of over 700 jin. After comparative tests over large areas, the yields differed by 20 to 25 percent. After implementing the responsibility system, the same piece of land was divided among several families for planting in order to match good and poor land. The land could not be uniformly used for seed propagation, and this affected the purification and strengthening of the seeds. Several dominant wheat varieties in Henan such as the zheng ying No. 1 have seriously degenerated. The seeds provided by the state superior seed farms and stations for production cannot satisfy the requirements in large area planting, and the production brigades have to propagate seeds themselves for their own use. This has greatly affected the cultivation of superior varieties by the brigades and purification and strengthening of seeds.

IV. Because of the lack of understanding of science, it is difficult to realize superior quality and high yields, and in the application of fertilizers and in the use of farm chemicals, accidents have continued to occur and some accidents were serious. Because of a lack of knowledge about scientific planting, some commune members exerted a lot of effort in the hope of producing high yields but were not successful. Some exerted efforts, spent money but could not increase yields, on the contrary, the yields reduced. There were many such cases. For example: The year before last, wheat was planted in the private plot of land of 7 fen by Wang Juncai [3769 3971 2088] of the Peizhang Brigade of Yangwu Commune in Lingbao County. He applied 5 cubic meters of mud fertilizers once and 150 jin of urea. He thought that there would be no problem in producing 1,000 jin. As a result, the plants greened prematurely and matured late and he harvested only 200 jin. Wang Shunxiang [3769 7311 4382] of Zhangcun used a weeder for cotton fields in the wheat fields to prevent underground insects. He used too much. None of the wheat seedlings emerged and for several seasons, he did not harvest anything he planted and nothing planted stayed alive. In some cases, deaths even occurred. This is the serious result of a lack of scientific knowledge and management and of improper use of farm chemicals.

Aimed at the above situation, an important problem that is worth our attention and that urgently needs to be solved under the situation where the responsibility system in agricultural production is widely implemented is how to develop agricultural science and technology and how to develop the function of science and technology in promoting agricultural production. According to preliminary experiences of various localities, we should pay attention to solving the following problems:

(I) We must clarify the guiding ideology. After implementing the responsibility system in agricultural production, some problems have emerged in scientific and technical work. There must be a correct understanding. The solution of these problems will benefit the consolidation of the responsibility system, the development of agricultural production, and the realization of more and better results in agricultural scientific research. Otherwise, the enthusiasm of the farmers to learn science and technology will be dampened, our efforts will be detached from the basic requirements of the masses of farmers, affect the development of agricultural scientific research and the development of agricultural production, and even negate the good situation in the farm villages.

(II) We must actively cultivate new forms of scientific research in farm villages. As the responsibility system in agricultural production is consolidated and develops, many forms of scientific research have emerged in the farm villages. Some scientific research organizations have shown a strong life force and have served an important function in promoting agricultural production. Now it seems the following forms should be advocated in the future:

1. The scientific research stations of production brigades must implement specialized contracts. Practice proves that after implementing the responsibility system in agricultural production, the scientific research stations of production brigades must not be abolished, on the contrary, they need to be strengthened. The problem is to change their contract method and form of distribution. Scientific research stations of production brigades can implement the four fixed quotas and the three contracts and be rationally distributed. This means establishing a fixed labor force, fixed area of land, fixed number of livestock, fixed agricultural machinery, guarantee varieties, output and production value. Surplus output can be divided into 40 percent and 60 percent shares or 30 percent and 70 percent shares, i.e., the 60 or 70 percent given to the individual, the 30 or 40 percent given to the production brigade as public funds. The main task of the scientific research stations of production brigades is to propagate superior varieties (including purification and strengthening of seeds), introduce and test new varieties suitable for planting in the locality.

2. Scientific and technical families should be developed. This is a new thing. We must follow the principle of active, cautious and stable development. We must never forge ahead and abandon efforts quickly. Now, the whole province has already developed 60,000 to 70,000 scientific and technical families, constituting 0.5 percent of the total number of farm families in the province. Some counties have already developed 1,800 families, constituting about 1 percent. Facts prove that scientific and technical families have served a demonstrative and backbone function in scientific planting. The output of scientific and technical families is higher than that of other farm families. For example: Scientific and technical family member Hu Shutong [5170 2579 0681] of the Fifth Production Team of the Sumu Brigade of Sumu Commune in Qixian and six commune members under his leadership planted soybeans. The per mu yield was over 300 jin while the per mu yield of other farm families was only 240 jin, less by 20 percent. There must be fixed conditions in selecting scientific and technical families before they can develop their function. These conditions generally include a sufficient labor force, a definite cultural level, and enthusiasm towards scientific experimentation. Scientific and technical families cannot be arbitrarily assigned and promoted. The farmers must apply to become scientific and technical families themselves and they must be recommended by the production team and the brigade, approved by the commune, and certified by the county science committee. Approved scientific and technical families can enjoy privileges of participating in technical learning on a priority basis, receive technical data on a priority basis, purchase superior seeds on a priority basis so that they can better carry

out the following duties: propagate superior varieties, conduct tests and demonstrations of advanced planting techniques, provide technical assistance and guidance for surrounding farm families.

3. Technical contracts should be signed and technical knowledge must be taught. This is a form of technical assistance rendered by scientific research organizations in farm villages and scientific and technical personnel in agriculture for agricultural production teams and the broad number of farming families. Through technical contracts, the sense of responsibility of agricultural technicians is strengthened. This responsibility is linked to the personal benefits of the farmers, and it unifies the activities of departments related to agricultural production in supporting agriculture and thus forcefully promotes the development of agricultural production. After farmers have seen the benefits of technical contracts, they have actively asked for technical contracts. For example, the five technical and materials departments of Huiting Commune in Xiayi County signed a technical contract to plant cotton with 4 production teams in 1980. The 197 mu produced a per mu yield of 129 jin of ginned cotton, an increase of 70 percent over 1979, and compared to fields not under contract, the increase in yield amounted to 12 percent. In 1981, the contract expanded to include 460 family commune members of 17 production teams. Bumper harvests of cotton were realized again in 734 mu. There are two ways to implement technical contracts: One is to contract technical work and guarantee output. The second is to contract technical work but not to guarantee output. Under the method of contracting technical work but not guaranteeing output, a small amount of technical assistance fee is charged per mu according to different crops. Under the method of contracting technical work and guaranteeing output, technical contracts must be signed. The content is generally as follows: A. The output goal is 5 to 10 percent higher than the average output of the past three years prior to implementation of the contract. B. The contractor is economically responsible for surplus output and reduced output. If a surplus is produced, the contractor is entitled to a percentage of from 5 to 15 percent. If the output drops, the contractor is responsible for paying 20 to 50 percent of the amount of output reduced. If the output is the same, the contractor does not retain a percentage nor is he required to pay for loss. C. The percentage of the surplus retained by the contractor must be rationally distributed, i.e., a portion of the percentage is to be used as floating capital for technical contracts, another portion is to be used as public funds of the production team, and still another portion is to be used to award scientific research personnel and cadres of the production teams.

To organize the various scientific research forces, some counties have been directly led by the agricultural bureau with a lot of support from the science committee and the science association to organize the scientific research institute, the agricultural machinery station and the agricultural schools together, forming a three-way alliance of technical experiment, popularization and training center in agriculture.

(III) We should develop and train technical forces in agriculture in a big way. To seize bumper harvests in agriculture, we must stabilize and implement rational agricultural policies, and the key is to popularize advanced agricultural science and technology in a big way. The organizational guarantee for popularizing advanced agricultural techniques is to greatly develop and train technical forces in agriculture. At present, we can see three ways to solve the problems in developing technical forces in agriculture. They are as follows:

1. We must develop the function of agriculturalists as consultants and assistants. According to our understanding, agriculturalists who are college graduates in a county are few, there are generally 10 to 20 people, but these people have rich scientific and technical knowledge in agriculture, and they have the experience of engaging in scientific research in agriculture for a long time, and with their long period of living in the farm villages, they are more familiar with the agricultural situation. They are the backbone scientific and technical forces in agriculture. Therefore, fully developing the function of these people will serve a great function in training technical forces in the farm villages and in promoting agricultural production. Some localities have already acquired preliminary experience in this regard. For example, Yongcheng County in Shangqiu Prefecture organized the agriculturalists working in agencies directly under the county government under the leadership of the county science committee and the science association. They served as consultants to the county committee and government, proposed many good suggestions, and after the suggestions were approved by the county they were actively carried out. They have already developed a good function. This experience can be popularized throughout the province.

2. The elementary level scientific and technical personnel in agriculture should gradually be localized. When we conducted surveys and studies of Neihuang County, we discovered the following problem. In 1980, the Luoyang Forestry School assigned two graduates to that county. They went to that county for one year but did not do a day's work. Then they were transferred back to the Luoyang area. Facing this situation in this county, the county governor suggested to us that elementary level scientific and technical personnel in agriculture must be localized. There were two methods. One was that key agricultural schools should consider each county in admitting and assigning students. The admission of new students under the same conditions should include each county and graduates should be assigned to their original counties to work. The second was that a number of farm village high schools should be converted to agricultural schools. Graduates of agricultural schools should first be assigned to the schools to teach and to train other groups of scientific and technical personnel.

3. We should select and train farmers as scientific and technical personnel in a big way. To solve the deficiency of technical forces in farm villages, we need to select a group of people from young and strong farmers who have a cultural standard, who have practical experience and who are enthusiastic about scientific research for technical training. After technical evaluation,

they should be given the title of farmer technicians. This is a technical title, they are not excluded from production and they are not considered state cadres. But, they must be trained according to plan. In this aspect, the provincial science association has done something deeply welcomed by the masses. A group of farmer technicians was selected and sent to Baiquan Agricultural School for training. Two classes have been trained. Each class lasted for 3 months and a total of 108 people have been trained and they are now distributed in 99 brigades throughout the province. During the three months of learning, the wheat class offered 330 hours of class time, the cotton class provided 440 hours of class time. This was equivalent to two years of spare time learning. The courses included breeding, cultivation, physiology, soil, fertilizer, plant protection and use of instruments. After graduation, the graduates led efforts to popularize agricultural techniques, and every student held his own technical learning class for farmers. Now, 20 classes are offered throughout the province.

(IV) We should develop propaganda for the popularization of science in a big way. To adapt to the needs for learning science and technology by the broad number of farmers, besides technical training, the main effort is to widely launch many forms of propaganda campaigns to popularize science. In this regard, many flowers bloom and each has its special skills. For example, radio broadcasts of scientific and technical knowledge, printing and issuing of specific technical information, holding short term technical training classes, placing scientific and technical advertisements, opening up technical night schools, organizing roving technical report teams, setting up temporary science and technology propaganda stations, roving propaganda vehicles etc. Regardless of the form, each serves a definite function and they are all welcomed by the masses.

(V) We should organize technical service companies to serve scientific planting by farmers. In this regard, there are two types. One is the comprehensive agricultural techniques service companies. They perform technical measures, supply materials and provide technical training. The other is the special companies, such as the seed companies, plant protection companies, agricultural machinery companies. Throughout the province, 1,800 production teams of 344 brigades of 156 communes in 61 counties and cities have already established plant protection companies and specialized teams. The area that has been machine-tilled and protected has reached 5,700,000 mu. It is estimated that the output of wheat will increase by 140 million jin, and cotton will increase by 400,000 dan and oil crops will increase by 25,000,000 jin. In all county communes which have established plant protection companies, insect pests and diseases have been greatly reduced, and accidents of poisoning by farm chemicals have been eliminated. Because forecasts and machinery prevention and control of diseases and insect pests were implemented, three savings, two increases and one timeliness were realized when compared to manual prevention and control efforts, i.e., saving labor (30 to 50 percent), saving chemicals (20 to 30 percent), saving investment (20 to 30 percent), higher work efficiency (30 to 50 percent), higher efficiency of farm chemicals (8 to 11 percent), and controlling diseases and insect pests in time.

(VI) We should adjust the direction of production of farm machinery so that the production of farm machinery can better serve efforts to consolidate the responsibility system in agricultural production. In this regard, the Shangqui Farm Machinery Plant has provided us some experience. This plant suffered a deficit of 1.8 million yuan in ten years because its products were not suitable in the past. Beginning from last year, it readjusted its direction in production. It changed from manufacturing large farm machinery to small farm machinery and it made a profit of 500,000 yuan in two years. Now, the 7-cun walking ploughs and long tine rakes produced by them have become hot items and are deeply welcomed by farmers.

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CSO: 4008/9

# TECHNICAL TRANSFER OF AGRICULTURAL SCIENTIFIC RESEARCH RESULTS DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No 4, Oct 82 pp 53, 63-65

[Article by Zhao Shunliang [6392 2633 5328], Huang Jixian [7806 4949 6343], Tao Guozhen [7118 0948 3791] of the Scientific Research Department of the Beijing City Agricultural Sciences Institute: "On the Question of Transferring the Technology of Scientific Research Achievements in Agriculture"]

[Text] The question on how to promote scientific research achievements in agriculture to quickly become direct productive forces has always been one of the questions emphasized by the departments responsible for the work and concerned scientific research units. But for a long time, this problem has not been solved well, and thus there is a fairly large number of scientific research achievements that still remain as "exhibition items, samples, gifts," and they cannot contribute more towards developing the economy and towards promoting the development of agricultural production. One important reason is that the problem of transferring technology has not been solved in theory and in practice. This article presents some immature opinions in the hope that comrades will criticize and correct them.

## (I) The Importance of Transferring Technology

Scientific research achievements, as a form of knowledge, generally speaking, are only a kind of potential productive force. To materialize this potential productive force and to make it become a direct productive force, we still must carry out the process of transferring and applying the technology begun by scientific research achievements. Only by using science and technology directly in production can we realize practical economic and social benefits brought about by science and technology. But to utilize science and technology in production, we must also carry out a difficult and detailed process of transferring technology from being scientific research achievements into direct productive forces. Reviewing the experience and lessons of past years, we can clearly see that it is exactly in this important link that we did not have a sufficient understanding of its importance, we lacked detailed organization and forceful measures, and the work to change scientific research achievements into direct productive forces was greatly affected.

In the current system to popularize science and technology. scientific research, popularization and production each has its own duties, and work is divided and coordinated. But, in actual work, the divided functions are frequently not connected, emphasis is placed only on division of work while active and organized coordination is lacking. The situation described above has seriously affected the work of transferring technology begun by scientific research achievements. This is one reason. The second is that while all sides begin to cooperate with each other, the work of transferring technology is not as simple as a "relay competition" in which the "stick" is simply handed over to the other party. This is because a scientific research achievement frequently includes complex technology, it involves many factors, and to utilize them well, we need to undergo a process of familiarization, digestion and understanding.

We cannot deny that it is most ideal and most beneficial for the person who completes a scientific research achievement to personally transfer the technology of this achievement. This is because nobody can deny that the person who completes a scientific research achievement is most familiar with and understands the range of application, the degree of maturity and the technology related to his own achievement. But, this is exactly the problem. The irrational division of functions in current efforts to popularize scientific research has created two problems: One is that scientific research units complete their tasks as soon as the scientific research achievements have been evaluated. On the other hand, the popularization units popularize such achievements independent of the people completing the achievements. In this way, the work of transferring technology from the realization of scientific research achievements to their popularization and application is cancelled.

In this question, foreign nations have some experience which can be used as reference. For example, in the United States, the work of transferring technology and applying scientific research achievements is done by the person who completes such achievements himself. Concretely, even though a certain scientific and technical person places emphasis on scientific research or popularization, the two are not absolutely separated. Although the Soviet Union divides functional agencies into those for scientific research and those for popularization, in recent years, it has placed a lot of emphasis on signing scientific and technological production contracts between scientific research units and production units and on the organization of "joint entities for scientific research and production." The purpose is also to solve the difficulty in popularizing scientific research achievements. In summary, we come to the following conclusion: I. During the course of changing scientific research achievements into a productive force, the work of transferring technology begun as scientific research achievements has an outstanding importance that should be highly emphasized, and forceful measures should be taken; II. The work of transferring technology generally should be carried out with the personal participation of the person who has completed the achievements.

## (II) The Way to Transfer Technology

If we say that allowing the person who completes scientific research achievements to do a part of the work of transferring technology of his own achievements is rational, then combined with the situation in our nation, we should correspondingly point out two problems: I. The tasks of scientific research units should not only include evaluating the achievements, but they should also include a part of the task to transfer the technology of the scientific research achievements realized by the units themselves; II. After the tasks of scientific research units have been appropriately changed, how should the work of the popularization units be linked?

In recent years, our academy has begun preliminary work surrounding the first question. This began mainly because of the need to change scientific research achievements to productive forces and the needs of scientific research itself. After crushing the "gang of four," our academy summarized the positive and negative experience and lessons on the scientific research battlefront in agriculture over the past years. We more clearly recognized that to better develop the promotional function of scientific research in agricultural production, we must insist on the three-way alliance of the laboratory, the test farm and the basic farm village. We must insist on the three-way alliance of scientific research, demonstration and popularization. Only in this way can efforts coincide with the characteristics and laws of scientific research in agriculture, realize completeness and regional adaptation of scientific research in agriculture, and only in this way can scientific research be proven by demonstration and partial popularization and absorb rich nutrients, and thus contribute to the realization of closely combining scientific research and production and promote the change of scientific research achievements towards productive forces. In this regard, we generally used the following three methods:

I. We conducted joint tests with related prefectures and counties. On the basis of results achieved in stages by the laboratory and the test farms in preliminary experimental research, we further proved the results in joint tests at many localities, we examined their technical and economic effects and the scope in which they can be suitably used. This is a necessary step in scientific research in agriculture and it also serves the function of transferring technology. For example, some research subjects in breeding and cultivation were arranged in this way.

II. We conducted demonstrations of scientific research achievements at scientific research bases in farm villages, gradually formed a base for the popularization and application of the achievements. For many years, some of our research subjects have been carried out at base localities in farm villages by combined efforts between the institute and other outside units. The scientific research achievements were first applied at the base locality to transfer their technology. For example, the Forestry Institute of the academy conducted experiments to selectively breed new varieties of Chinese chestnuts and to produce bumper harvests by dense planting. This began in 1973 at the Lizhenshai scientific research base in Miyun County. In 1979, two new varieties of chestnuts were evaluated and named the "Yanshan red chestnut" and the "yanfeng." A nursery for the grafting of spikes of superior varieties of chestnuts was also established in Lizhenzhai. Besides efforts by that brigade to popularize the varieties, we also popularized over 300,000 graft spikes of superior varieties elsewhere and we supported the development of new varieties of chestnut trees in Miyun, Huairou and Fangshan.

III. We actively launched scientific and technical consultation services, signed cooperative contracts in scientific research and production. In the spring of 1980, our academy's Animal Husbandry Institute and the Crops Institute separately signed three scientific research and production contracts with the Jiulan Chicken Farm, the Xishacun Hog Farm and the Caihe Brigade of Shahe Commune in Changping County. The main content of these three contracts was as follows: 1. We provided the projects for applying scientific research achievements, we were responsible for technical guidance, we guaranteed realization of the goals of the output plans agreed upon by both parties; 2. The production units were responsible for organizing production according to contract stipulations and technical requirements; 3. Both parties developed scientific research projects stipulated in the contract together, the production units were responsible for providing corresponding manpower, materials and sites; 4. Both parties established a method of awards and penalties to closely combine production efforts, results of business operations and material benefits of both units and personnel. Last year, the three contracts were carried out well and welcomed results were realized. Since the beginning of this year, this work developed further on the basis of last year's work, and "temporary rules on scientific and technical consultation services: were established for our academy. The essence stipulated that the development of this work must mainly be the application of scientific research achievements realized by our academy to mobilize and develop the presently available technical potential of our academy (including personnel and equipment).

Some research achievements in other aspects, such as basic survey, agricultural zoning, agricultural environmental protection were directly provided to related units as scientific reference in establishing plans and in guiding production

Based on the preliminary practices described above, we believe the transfer of technology of most of the scientific research achievements in agriculture can be carried out at the scientific research demonstration bases in farm villages with the direct participation of the persons completing the scientific research achievements. Furthermore, this work should be carried out at the base localities in farm villages with the participation of scientific researchers, those engaged in popularization and direct producers under unified coordination by a higher echelon unit until the demonstration of this scientific research achievement has realized the expected benefits and until related technologies have been popularized and have been grasped by the production units. Then, the popularization units should mainly be in charge of the work of popularization and application over large areas and in a wide range. It is more rational and feasible to carry out transfer of technology by a combined body of scientific research, popularization and production--a base locality for demonstrating scientific research achievements.

## (III) Some Ideas About Promoting the Transfer of Technology

We propose the following ideas in line with the basic starting point and preliminary practices described above to further improve scientific research work, to solve the problem of joining scientific research and popularization and to concretely promote the development of transfer of technology:

I. The tasks of scientific research units must be correspondingly changed. The tasks of scientific research units not only involve producing talent and achievements, they also should be responsible for the transfer of technology to application and partial application. (Here, we are mainly referring to the application at base localities for demonstration). The benefits of doing so are: First, it changes the irrational situation of the past when the popularization of scientific research achievements was carried out independent of the person who completes the achievements, hastens and perfects the transfer of technology begun after obtaining scientific research achievements; Second, it strengthens the link between scientific research activities and economic activities. Because, as the technology of scientific research achievements is transferred and partially applied, technical and economic benefits will be manifested more visibly, and this will surely stimulate the concern of scientific research units and scientific research personnel for obtaining practical results in applying the achievements; Third, it can place scientific research units and scientific research personnel both in a dynamic cycle of "selecting subjects--research--evaluation of achievements--practical application." Because, to the scientific research unit, direct feedback from practical results of application of scientific research achievements shows whether the achievements are successful or not and whether the subject has been selected appropriately or not. These are all intangible examinations and revisions to determine the future direction of the tasks, to establish research topics and to trace research plans. To the scientific research personnel, the participation in the entire process described above helps their own research activities and helps them to acquire a more overall understanding of the results so that better achievements can be realized in future summarization of experience and lessons.

Practice proves that as long as we correctly handle the mutual relationships between the four steps described above, rationally equip and organize strength, it is feasible for scientific research units to carry out the tasks described above. Because the various research subjects of a certain scientific research unit are not always in the same research stage within the same period, this avoids "rushing ahead," and this creates conditions for objectively grasping the overall situation and rational distribution.

In addition, the realization of the above ideas still relies on the guarantee of a concrete system. For example, recently, some localities have proposed that after scientific research personnel complete a certain research subject, they must track the achievements they have realized for three years. We believe this is a very good suggestion. We could stipulate that in the future, the tasks of scientific research personnel after they have completed a certain research achievement should be the following: (1) Carry out their own demonstration to apply the achievements realized themselves and carry out the work of transferring the technology; (2) Understand the superficial dynamics of application of their achievements; (3) Carry out investigative research in future scientific research work. We should also be cautious in evaluating awards and giving encouragement for scientific research achievements evaluated. Awards and evaluation must take into consideration the practical results of application of the achievement over a three year period.

II. We must solve the problems in dividing tasks and linking the tasks in popularizing scientific research under the new situation. In the new situation, what is the task of the popularization units? Our ideas are: (1) to be in charge of popularizing technology already fully proven by demonstrative experiments within one's own locality over large areas and in a large range. This is because the work of popularizing agricultural technology in a certain area requires an overall unified arrangement to facilitate a selective absorption of the technology. (2) They should carry out necessary popularization research when popularizing a certain technology. One effort is to examine its regional adaptability, the second is to see whether specialized scientific research agencies can satisfy the requirement of diversifying an agricultural technology within their own region. (3) They should cooperate with scientific research units to transfer a certain technology that has an important function in their own locality. As mentioned above, this work is best carried out at agricultural bases to create conditions for future popularization over large areas. Here, we need to emphatically point out that allowing the scientific research units to concurrently be in charge of transfer of technology and partial popularization and application is based only on the desire to benefit the development of scientific research itself and to enable scientific research achievements to be applied and to be quickly changed to a direct productive force. It is not to replace the task of popularization units in an attempt to "do everything by oneself." Therefore, there is a question of grasping the "degree" here. This must be appropriate. Otherwise, inappropriately emphasizing that scientific research units should participate in popularization and application will affect the internal balance of scientific research units.

We believe that appropriately handling the mutual relationship between scientific research and popularization will not only better satisfy the requirements of scientific research, prove and enrich scientific research achievements, stimulate achievements to become productive forces, open up sources for the development of scientific research, it will also concretely guarantee the transfer of technology, strengthen vitality in popularization, and create favorable conditions for future popularization of advanced technology over large areas and in a large scope.

(Appendix: Illustrative diagram of the combined department)

Scientific research unit

Popularization unit

Transfer of technology

Demonstration bases in farm villages

Select Research Achievement topic

Popularization study

Large area popularization

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CSO: 4008/9

# INTEGRATION OF SCIENTIFIC RESEARCH WITH PRODUCTION EVALUATED

Beijing RENMIN RIBAO in Chinese 19 Sep 82 p 3

[Article by Zhao Dongwan [6392 2639 1354], vice chairman of State Scientific and Technological Commission: "Investigation on How Dalian Organizes the Integration of Scientific Research With Production"]

[Text] The development of the national economy necessarily depends on science and technology, and science and technology must serve the national economy. This is China's new policy in developing science and technology and in promoting economic development. In order to implement this policy, it is necessary to regularly sum up organizational forms that are capable of bringing scientific research and production closer together.

Over a year ago, a form of integration of scientific research with production made its appearance in Dalian. As soon as it was instituted, it showed that it had unique advantages and strong vitality. In June of last year, we went to Dalian to make on-the-spot observations of this new organizational form. We were greatly inspired. Recently we returned to Dalian to gain further insights. For the past year and more, the integration of scientific research with production has made new headway in dealing with key problems in science and technology and in improving economic benefits. There have also been new organizational developments.

Units participating in the integration system of textile printing and dyeing which was set up over a year ago have increased in number from the original 15 to 23. After a year of concerted effort, laboratory research has basically been concluded on six integrated scientific research and production processes involving colored fibers, medium-length yinqiang [silver-spear] overcoating and kaohua [roasted-flower] overcoating, modified dacron fibers, long-fiber imitation woolen fabrics, and finishing and dyeing. They have entered intermediate testing or the batch process phase. Some have already been put into full production.

At the beginning the integrated system of modular machine tools only had six member units. It has now increased to 12 units. It has expanded from the integration of design and production to the integration of scientific research, design, and production and has evolved a capability for undertaking general contracts encompassing the design of locally built plants, special uses for general purpose equipment, and the design and manufacture of all kinds of special purpose modular machine tools. They undertook technical transformation projects in manufacturing plants for bicycles, sewing machines, motorcycles, textile machines, etc. They also undertook projects for assembling imported items in automobile plants. Within a year they signed 50 contracts.

An integrated system in the refrigeration equipment manufacturing field was newly established on the basis of the Dalian Refrigeration Equipment Plant and is composed of four research institutes and four chemical, rubber, and plastics plants. The first task of the integrated system after it was set up was to study the trial manufacture of urgently needed movable refrigeration lockers of 50 cubic meters capacity. They made a concerted effort to tackle problems in integration and in only 8 months completed a prototype for evaluation. Although the product had not yet left the plant, certain consumers at home and abroad had already asked to place orders.

The integration of scientific research with production in Dalian has occurred among a certain number of economic entities and scientific research units. The goals are to promote the development of production through scientific research and to strive to improve economic benefits. The lever is mutual economic benefits. It is a loosely integrated system of technology and commerce with an unchanging subordinate relationship to the administration. Their year of actual experience has proved that this kind of integration encourages science and technology to serve the economy better and, at the same time, also enables the development of production to rely on further technical advances.

Superiority flows from the integration system. The integration of scientific research and production systematically combines scientific research, design, intermediate testing, trial manufacture, and production. It has brought about cooperation in tackling key problems in integration as well as cooperation among productive forces in an increased number of disciplines and professions. This integration has brought together the ability to solve key problems in science and technology and productive capabilities. It has created an even greater superiority. For example, when confronting the problem that common dacron fibers were unmarketable because of poor color properties, the integrated system of textile printing and dyeing organized to develop ways to modify the dacron fibers. Information, advice, and product analyses were supplies by Dalian Institute of Technology. The research institute came up with solutions for the modifying and finishing technologies. The textile plant took responsibility for the textiles, and the printing and dyeing mills dealt with printing, dyeing and finishing. Each member unit gave full play to its own superiority, so that within one year resins were developed for modifying 25 kinds of dacron fibers and over 50 designs and colors were developed which were bright and lustrous with unique styles. They received favorable reviews by all. Speaking from their own intimate knowledge they said: "In order to have top quality new varieties, it is necessary to have an integrated system. In particular, it is necessary to achieve integration by combining areas of specialization."

Speed flows from integration. Because the integrated system has had to deal with key problems in scientific research and production based on the needs of production and the market, research units have given top priority to key scientific research problems whose solution is urgently required by enterprises. They have also fully taken into account the conditions of actual utilization in enterprises. Enterprises, in turn, have given top priority to providing the conditions for extended tests and have been able to put their positive results into production ahead of schedule. This system, thus, has greatly reduced the period of time required for the positive results of scientific research to move from the laboratory to the plant and has noticeably increased the utilization rate of positive results of scientific research. For example, the members of the integrated organization for modular machine tools have joined together to develop general purpose components for precision modular machine tools. In only a year and a half they completed the basic trial manufacture of the product. Not only did they finish it more than a year earlier than had ever been done before, they also increased precision by one or two degrees as compared to the original.

The benefits flowing from integration are great. Due to the fact that this system of integration has given form and free rein to a synthesis of scientific research on key problems and developed productive capacities, it has attained certain economic benefits within a comparatively short period of time. For instance, in the integrated system of textile printing and dyeing, in a little over a year central and local authorities have spent 1.4 million yuan on scientific research. The taxes and profits created from this amount to 3.67 million yuan, which is 2.6 times the amount invested. Another example is that after all the trial manufacturing projects are put into full production, initial estimates for actual output value indicate a possible net increase of over 36 million yuan, which is equivalent to more than 4 percent of the total output value of the textile industry in the municipality. A further example is the integrated system of modular machine tools. In the past two years it signed a total of 87 contracts involving scientific research, design and manufacturing, whereby it undertook to trial manufacture 388 varieties and 421 pieces of equipment. This not only solved existing problems of certain member enterprises such as insufficient assignments and economic losses, but also increased variety, upgraded quality and improved technical services and economic management.

Integration has encouraged the development of technology and science. In the system of integration, production enterprises have supplied scientific research units with the benefits of their own specialized technical experiences and prototype manufacturing as well as the results of industrial tests. This has encouraged improvements in the standards of scientific research. For example, because of the cooperation of enterprises with the research institute of the integrated system of modular machine tools, it was able to learn from the plants' experiences in designing and manufacturing jig boring machines. As a result, the precision of the boring head of the new model of modular machine tool reached 2 microns. As for the precision of the [sliding] guiderail, the deviation per meter did not exceed 5 microns. At the same time, scientific research units within the system of integration may also obtain a certain share of the income according to the principle of mutual economic benefit. Under present conditions of a shortage of funds for scientific research, this could solve certain problems.

Within a short period of time the integration of scientific research and production in Dalian has developed fairly rapidly and has fully demonstrated that this new organizational form is suited to the current needs of scientific, technical, and economic development. The important points of the experiences of these systems are discussed below.

(1) On the basis of adhering to the principle of voluntariness necessary administrative organizations and intervention were carried out.

The member units of the systems of integration are participated voluntarily. However, under the conditions of the system currently in effect, it has been necessary for higher-level authorities to carry out the needed organization and coordination to help resolve certain problems in cutting across professional and administrative systems. Only in this way has the system of integration been allowed to develop. The Dalian Municipal CPC Committee, the municipal government and the municipal science commission did a great deal of work in this area, and it was well received by the basic level units.

(2) On the basis of upholding mutual economic benefits, the emphasis has been on striving to work in cooperation and to foster this style.

The mutual economic benefits among member units in the integration system were guaranteed by various economic contracts. This is the loose yet reliable economic bond of the integration system. In order to strengthen the close cooperation among the various units, it is necessary to stress coordination and style. This is the ideological foundation behind the development and expansion of the integration system.

(3) On the basis of upholding that science and technology serve the needs of production and the market, they stressed giving priority to scientific research.

Experience has shown that the emergence and development of the integration system stemmed from the needs of production and the market. However, in order to open up new prospects and obtain greater economic benefits, it is necessary to give priority to scientific research and to constantly promote new achievements. Integrated systems of scientific research and production differ strikingly from ordinary industrial corporations or integrated production systems in that they require a strong competency in technological development. The technological level of products is first-rate and they are all definitely competitive.

As the integrated system of scientific research and production in Dalian has developed and matured, it has encountered certain problems. The primary problem is that the organizational form of the integration system has been restricted by the present economic system. In particular, planning channels and methods for profit sharing in the integrated system require that concerned departments of the state set down appropriate regulations based on the new conditions.

Dalian's integrated systems of scientific research and production continue to conduct thorough tests. Without doubt this is a very significant form of integration. If the many scientific research units in every large and medium sized city as well as some of the research institutes and laboratories of the major specialized colleges and universities were to form an integrated system with the appropriate enterprises based on their area of specialization, in a certain sense, the former could also serve as the technical development sections for the latter. They could undertake the task at various levels of administration of a coordinated process from tackling key problems by science and technology to developing new products. This would not only effectively promote economic development, it is also the way to reform the organization and structure of scientific research.

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CSO: 4008/1

# CAS PRESIDENT ON REVAMPING ACADEMY'S SCIENTIFIC RESEARCH WORK

HK100955 Beijing RENMIN RIBAO in Chinese 9 Dec 82 p 5

[Article by Lu Jiaxi [4151 0857 6932], president of the Chinese Academy of Sciences and secretary of its party group: "Cater to Economic Construction and Strive To Create a New Situation in the Academy's Scientific Research Work"]

[Text] For over a month now, scientific and technological personnel of the Chinese Academy of Sciences have been seriously studying and discussing the important speech delivered by Premier Zhao Zhiyang at the National Conference for Science Awards. They have also raised many constructive and realistic opinions and suggestions on the issue of how to implement the spirit of this speech. People commonly felt that Premier Zhao's speech profoundly expounded the relationship between science and economic construction, further set a clear guiding principle for scientific and technological work and economic work and was of great guiding significance to scientific work throughout the country as well as in the Academy of Sciences.

On the basis of the mass study and discussion and through repeated consideration, the party group of the Chinese Academy of Sciences has set forth its tentative ideas on five aspects of how to implement the spirit of Premier Zhao's important speech and, by catering to the demands of economic construction, strive to create a new situation in scientific research work. They are as follows:

1. Taking an active part in planning work. We shall take the initiative in mobilizing scientific and technological personnel to take part in the work of national scientific planning and economic planning as well as in the work of drawing up trade plans, regional plans and plans for key enterprises and we shall do this in a more conscious and better organized way. The Academy of Sciences may play its role in planning work in the following three aspects: 1) Some research institutes of the academy have accumulated a great deal of basic data with regard to natural conditions, resources, environment and ecological conditions through their long-term observation and search and they have studied many methods for comprehensive development of some regions. All this can serve as scientific foundations for economic planning and regional planning. 2) The academy has many specialists in all branches of science and a group of academicians who are selected from outstanding scientists in all branches throughout the country. They can make valuable contributions to all kinds of

planning work by giving their suggestions. 3) The academy has scientific research strength in the fields of applied mathematics, system science, economic geography and computer science; thus it can offer some appropriate methods and make comparisons between different schemes for planning work.

At the same time, in working out its own development plans, the Academy of Sciences should take the guiding principle of strengthening the study of applied sciences, placing stress on the study of basic sciences, gearing to economic construction and taking part in the practice of economic construction. Its policy for the development of branches of science should be to continue to give priority to the development of those branches of science which are closely related to economic construction and have important potential for application, especially those that have the possibility of leading to the creation of new production fields. It is necessary to continue to set store by certain important frontline fields of scientific development and the branches of science in which we have gained solid foundations. When arranging tasks, we should reasonably combine short-medium- and long-term tasks. In the next few years, we should place stress on solving the urgent problems in economic construction, in particular, the problems concerning agricultural development, energy conservation, technical transformation of enterprises, assimilating and improving the technology imported from other countries and the improvement of economic results. In the period of 5 to 10 years from now, we should solve a number of major overall problems of economic construction, score a number of important and applicable achievements and raise the development and application of new technology and new branches of science to a new level. At the same time, we should reserve necessary strategic strength for the development of science and technology in the last decade of this century.

2. Making great efforts to tackle key projects and striving to create useful results. We must prepare to properly organize relevant strength throughout the academy and form several columns of shock troops so that we can correctly select and effectively tackle a number of key projects which are urgently needed for economic construction and are able to bring about good economic results. Now we are planning to tackle more than 30 key projects that have been selected. In dealing with them, we must do a good job in organization, strengthen leadership and properly cooperate with parties concerned outside the academy. Apart from setting up a leading group at the academy level and an office in charge of planning the work of tackling these key projects, principal leaders of the academy should respectively take charge of one or two major projects and give effective direction of the work. In order to give play to our advantages and better serve economic construction, we should, on the basis of existing strength, set up a number of research development centers (for example, in the fields of integrated circuit and computer, computer software, bioengineering and new types of material) and research service centers (such as laser and optical instruments, remote sensing technology and so forth).

3. Selecting research projects by going deep into reality and strengthening our connections and cooperation with economic departments. The academy and some of its branches and institutes have organized some scientific personnel to make specialized investigations in some relevant departments, cities, rural areas and enterprises. Some have also invited comrades from industrial departments to give lectures so as to acquire knowledge of the problems in production

and plans for the development of production technology. On the basis of this, we can study and select suitable projects of scientific research and discuss ways to cooperate with economic departments. In the future, the Academy of Sciences will continue to find out the needs of various departments for science and technology and try to seek all possible ways of cooperation, including the establishing and expanding of some close relationships of long-term cooperation, such as jointly running research institutes, technological development companies and establishing scientific research and production bodies and experimental factories. We may also send our personnel to take concurrent jobs in economic units.

[HK100957] 4. Organizing strength and seriously popularizing the application of scientific achievements. The headquarters of the academy will set up a scientific and technological consulting service company which will be responsible for popularizing scientific achievements and offering technical service. At the same time, we should actively popularize and transfer scientific achievements through holding exhibitions, exchange meetings and other channels. When assessing, examining and evaluating achievements of scientific research, we should take specific steps to sort out, wherever possible, systematic technical data of all applicable achievements and to analyze and evaluate their technical and economic feasibility so that we can offer better technological service. We will select and undertake some suitable experimental tasks for industrial production and build a small number of experimental factories.

5. Consolidating our research institutes, revising and perfecting some policy regulations. We plan to take 2 or 3 years to carry out overall consolidation of all our research institutes so as to improve their work to a great extent. The improper regulations and systems concerning the examination, promotion, awarding and allowances of our scientific personnel will be revised and perfected within authority scope of the academy leadership or suggestions will be submitted to relevant state departments after investigations.

CSO: 4008/33

## INTEGRATION OF SCIENTIFIC RESEARCH WITH PRODUCTION SUCCESSFUL

Beijing RENMIN RIBAO in Chinese 19 Sep 82 p 1

[Article by staff correspondent: "The Benefits Attained by Dalian in Integrating Scientific Research With Production Are Numerous"]

> [Text] [Editor's Note] In his report to the 12th Party Congress, Comrade Hu Yaobang stressed the role of science and technology. He saw science as the strategic focal point of economic development. In order to better develop the role of science and technology in industrial development, various regions have created many forms of integration of scientific research and production. The integration of scientific research and production in Dalian reported on today is one such form. This integrated system has already demonstrated its important role in tackling key problems in science and technology and in improving economic benefits. In this respect it can accomplish much in large and medium sized cities. It is hoped that planning committees, economic commissions and science commissions in every region will work together and provide support for this. All ministries under the Central Committee should encourage enterprises and scientific research units under their control to participate in this integration.

In over a year Dalian has organized textile printing and dyeing, modular machine tools, refrigerating equipment and two other integrated systems of scientific research and production. This new kind of integration has demonstrated its great vitality in the areas of dealing with key problems in science and technology and in upgrading economic benefits.

The units participating in this integration must cooperate with each other and share the benefits. They must organically integrate the phases of scientific research, design, intermediate testing, trial manufacture and production into a single whole.

In early July, Comrade Zhao Dongwan [6392 2639 1354], vice chairman of the State Scientific and Technological Commission, observed and studied this system of integration in Dalian and summed up its experiences (see related article by Zhao, page 3).

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CSO: 4008/1

## SCIENTIST CALLS FOR STRONGER, MORE FOCUSED RESEARCH

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENOLOGY AND THE MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 3, 20 May 82 pp 15-16

[Article by Wang Zhancheng [3769 0594 2052], member of the science committee of Yancheng Prefecture: "China's Research in Scienology Should Form Its Own Unique Characteristics"]

[Text] In recent years, China's research in scienology has had a good start and considerable developments have been realized. The urgent task now confronting our scienology research workers is to further intensify research, to acquire skills, to combine the effort with China's actual conditions, and to form China's own unique characteristics in scienology research. There are several problems that are worth noting:

### I. Research Goals Must Be Concentrated

Scienology research must be centered on the most urgent problems in China. Of course, whether it is theoretical or applied scienology, there should be different divisions of disciplines, the key points should be stressed, there should be cooperative efforts, breakthroughs should be organized so that such efforts will have more practical significance and the important function of science and technology can be better developed. Today, the key targets should be th[illegible]ee: first how can science and technology be combined with the econom[illegible]luding questions concerning overall plans, to combine measures, form[illegible]ation and popularization of achievements, economic results and policies with joint ventures in scientific research and production. The second is the question of scientific and technological policy, from the strategy to develop science and technology in the future after the needs of economic development have been determined, the scientific and technological fields to be emphasized and developed, the proportional relationship among basic, applied and developmental research, the correct distribution of scientific research and so forth. The third is the question concerning the establishment of a highly efficient scientific research management system, including the establishment of teams, the level of decision-making, the rational distribution of funds, and legislation for scientific research.

### II. Research Methods Must Be Improved

Scienology research cannot proceed from book to book, and it cannot be institutionalized. It should be placed in the large system of science and technology--society--economy to study problems, to solve problems, to realize results and to do this, research methods must be improved. First, we must utilize the theory and methods of scienology such as scientific economics, scientific forecasting, scientific information centered around China's major scientific and technical fields or major engineering projects to concretely solve some major problems. Second, we must strengthen investigative research, delve deeply into the frontlines of scientific and technical fields and the realms of production to understand the current situation, to grasp the heart of problems, then to elevate efforts to theory and to summarize the regularities to guide the overall situation. Third, we must gradually utilize modern means such as computers to strengthen data processing and utilize the comprehensiveness of the situation to improve the efficiency of scienology research.

### III. The Research Team Must Be Strong

Now we are faced with two situations. On the one hand, there are quite a few people wishing to engage in research in scienology and the ranks are growing steadily. But on the other hand, quite a large number of scientific and technological management departments, some natural scientists and many leading cadres still have not paid sufficient attention to scienology. We should take measures and intensify work to strengthen the research team in scienology as much as possible. Comrades engaged in scientific and technological management work, people directly engaged in scientific research and the departments related to science and technology should all emphasize, study and develop scienology.

### IV. Research Standards Must Be Raised

We must change the past practice of scattered research to collective research, change the guerrilla tactics to whole tactics, exert efforts to write some papers on scienology that are analytical, that have unique viewpoints, that have plans for solving problems, that are of high quality and high caliber. We must organize, compile and publish special works that have our nation's own unique characteristics in scientific sociology, scientific economics and scientific forecasting. Localities with favorable conditions should organize research centers to study scientific and technological policies and scientific and technological management to guide the whole nation's research in scienology.

(Edited and distributed by Guan Zhou [7070 3166])

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CSO: 4008/197

# CURRENT ROLE OF SCIENTIFIC RESEARCH IN CHINA DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No 4, Oct 82 pp 50-53

[Article by Na Baokui [6719 1405 7608] of the General Iron and Steel Research Institute, Ministry of Metallurgical Industry: "Some Opinions on the Scientific Research System"]

[Text] At present, scientific and technical circles are discussing the concepts, relationship and functions of various types of research (such as basic research, developmental research and product research and so forth). This is a major problem related to the scientific research system. Clear discussion, consistent understanding and drawing up of principles and policies suitable to the laws of development of our nation's science and technology undoubtedly will promote the development of our nation's four modernizations.

## I. Classification of Research Systems

At present, there still is no unified opinion concerning the classification of research systems. In the United States, research is divided into basic research, applied research and developmental research. In Japan, research is divided into basic research, developmental research and product research. There are others who have proposed classifying research into research in principles, applied basic research and technical services. During discussion, the concepts are frequently ambiguous and the opinions are different.

Actually, this type of classification is mainly to differentiate between the various stages in scientific research. Viewing the laws of motion of scientific research itself, we can see that they cover the entire process from understanding the world to improving the world, i.e., the entire course of practice from theories to explore and understand the world to applying these theories to improve the world. Science is at the intersection of nature and technology while technology is at the intersection of science and society. The classification of the stages of scientific research should include science and technology and reflect the entire process of science and technology. In this sense, a scientific research system should mainly be divided into two stages: i.e., basic research and applied research. Basic research can be divided into free basic research and directed basic research while applied research can be divided into technological research and product research.

The English word development has many meanings, including initiation, expansion, progress, development, evolution, manifestation and occurrence. The Japanese translate the word as "kai hatsu" in our nation, the word is translated as "fa zhan." It is difficult to understand "developmental research" when the term is translated as "kai fan yan jiu" and "fa zhan yan jiu." Actually, it means changing a certain discovery in science into a certain invention in technology, and changing theoretical achievements in basic research into a materialized technology or product to benefit mankind. Isn't this applied research? Why should we use a foreign term that is difficult to understand?

## II. The Relationship Between Basic Research and Applied Research

Whether it is fundamental research or basic research, both are relative concepts within a definite field. In the field of "science," mathematics, physics, chemistry, astronomy, geography, biology are fundamental, and research in these disciplines is basic research, and most are free basic research. But in the field of "technology," computational mathematics, physics of metals, physical chemistry are fundamental, and research in these fields is also basic research, and mostly directed basic research. Free research generally is not carried out to solve a clear and near term goal. It studies the basic laws of various materials in nature and the connection between various natural phenomena. It is a potential productive force. Directed basic research frequently involves studies aimed at specific technical problems in society or production to find scientific theories or technical directions to solve these problems. It is a transient stage of a productive force moving from a potential form into a practical form.

Applied research is the study of productive forces. It directly solves technical problems in society or in production. It may be to invent a new technology and it may be to develop a new product. But applied research must be carried out on the basis of basic research, and directly or indirectly, it is an extension and the development of basic research. Without basic research, it is not possible to have applied research. Technologies and products that have not fully undergone basic research frequently cannot become established.

If a nation neglects basic research, science will surely become backward, and there will not be any major discoveries. But if applied research is neglected, technology will not progress, and the level of industry and agriculture will not reach a leading position. For example, India's basic research in atomic physics is not weak, but applied research is not strong and it has not become a nuclear power. Japan is more advanced in applied research but basic research is weak, as a result, it is an industrial power but a scientifically weak nation, and the number of Nobel laureates is few.

## III. The Structure and Division of Labor in Scientific Research

When discussing the scientific research system, we must consider the whole nation, we cannot analyze the situation from the viewpoint of only the scientific research structure of the Academy of Sciences. There are five types of scientific research units that actually exist at present in our nation: the system of the Academy of Sciences, the scientific research units of the industrial sector, local research academies and institutes and scientific research organs of companies, factories and mines, and the scientific research system of higher educational institutions. They have grown and strengthened gradually under the guidance of the Party over the past 30 years since founding of the nation and they are relatively complete scientific research teams. Of course, there are redundant specializations and agencies, and they need to be readjusted and reorganized, but each research system has its own advantages which cannot be neglected. Therefore when discussing the scientific research system, we must start out from the overall situation in our nation's scientific research structure before we can make a correct conclusion.

In China which has a large territory, many things and a population of 1 billion, basic research and applied research should all be pursued, and we must start out from the actual situation, determine a suitable ratio and practice division of labor. If our nation invests a lot of manpower, materials and money in basic research without exerting efforts to combine them with present economic buildup, the results will not be quickly realized. Even if we pursue basic research which only one or two advanced nations are willing to pursue, then we will have to "console ourselves with false hopes." Conversely, if we do not arrange an appropriate strength to engage in basic research and pursue only applied research (or developmental research), then we can only rely on other's discoveries to serve our needs and at the end, China's problems will not be solved. We are different from Japan, not only are the conditions of resources and energy sources different, the social systems are fundamentally different.

The Academy of Sciences and the higher educational institutions should mainly engage in basic research. Except for a few free basic research efforts, most should be engaged in directed basic research and such efforts should be combined closely with current socialist buildup. Research units of the industrial sector, the localities and the factories and mines should mainly pursue applied research to invent new technologies and develop new products to directly serve national economic buildup.

The present problem is that we do not have a sufficient understanding of the function of each stage of the scientific research system. The division of work in the scientific research agencies of the scientific research system is ambiguous and thus the structure of the scientific research system is in confusion. For example, the comprehensive utilization projects of vanadium-titanium-magnetite ores of Panzhihua and fluorine-niobium-rare earth iron ores of Baotou are two very important research projects. They should be divided into two categories of basic research and applied research. The Academy of Sciences and higher educational institutions should mainly engage in basic research while the research units of the industrial sector should engage in applied research. Now the situation is that the research units of the industrial sector are suffering because their basic work had not been done profoundly and thoroughly enough, while the Academy of Sciences is also engaged in new flow processes and higher educational institutes are also participating in testing new plans. Under this situation, why should we insist that the Academy of Sciences also engage in applied research (or developmental research) and the research departments of the industrial sector do the same? Research academies and institutes of some localities and factories and mines do not study problems in production technology present at their own locality and in their own factories and mines but contract other tasks, thus the tasks are redundant, there are many departments, plans are similar, the results are the same. The situation of wasting manpower, materials and money must be urgently turned around.

## IV. The Key Point At Present Is to Strengthen Applied Research

In view of the needs of our nation's present buildup of the four modernizations, applied research should be emphasized while strengthening applied research. We must emphasize basic research that is closely related to applied research.

Our nation's foundations in science and technology and in industry and agriculture are all relatively weak. Relying on basic research to build a strong nation will not realize results in time. Economic growth in the United States and Japan (especially Japan) mainly relied on technology, and applied research served greatly in economic development. We must also start out by strengthening applied research, develop applied sciences and use technology to promote the development of the four modernizations. The present problem is that efforts in basic research and applied research are detached. Those engaged in applied research lack necessary support from basic research. This means, basic research frequently has two tendencies, one is to separate itself from the nation's actual technological and economic situation and to pursue some projects that are beyond national economic capabilities. The other tendency is to research technological processes and products without thoroughly doing basic work. Basic research and applied research are not connected well. Some applied research departments should appropriately carry out some basic research work. For example, the technique of dynamic control of the top blown oxygen rotary furnace belongs to applied research. Using this technology enables the temperature of the steel produced by smelting in the rotary furnace and the carbon content in steel to simultaneously reach the preset goals, and thus reduce the oxygen content in steel, improve the quality of steel, shorten smelting time, improve production efficiency, conserve raw materials, reduce energy consumption and cost, and improve working conditions and the working environment. This research includes the following steps: (1) the development of the auxiliary gun (including mechanism, prevention of injury to the high temperature melt, accurate ascension and descent, positioning, prevention of lateral swinging); (2) development of the probe (including the integration of carbon fixing, temperature measurement and sampling, transmission of information and measurements); (3) establishment of dynamic control models (including decarburization, raising of temperature, controlling the results of using coolants, dynamic control methods); (4) on-site tests (including analysis of the reaction process inside the rotary furnace, the use of simulation methods to prove the accuracy of the models); (5) full automation of dynamic control. In the course of such research, there are many problems belonging to basic research. For example, the relationship between the carbon content and the solidification temperature of different steels, the distribution of the ratio of oxygen between carbon and iron, the relationship between the speed of decarburization and the rate of ascent of temperature, the absorption of the heat of solution after adding coolants and the release of the heat of reduction are all within the scope of basic research. Without these basic research achievements, applied research cannot be carried out. Even for technology and equipment introduced from abroad, we will not be able to grasp them if we do not completely understand them in both aspects of basic and applied research. This is why Japan spends one yuan for introduction but two yuan for research. In this sense, applied research is inseparable from basic research. Such basic research does not belong to the scope of mathematics, physics, chemistry, astronomy, geology and biology, it is the foundation of applied science and applied research, and it can also be called directed basic research.

## V. We Should Organize Efforts to Study Problems and Cooperate

Over the past 30 years, our nation has had many good experiences in scientific and technological work. And under the party's leadership, there have been many experiences that are suited to the socialist system and that have been effective. For example, the experience in developing the atomic bomb, the hydrogen bomb and artificial satellites is all worth summarizing and popularizing. One such experience is national unity and the organization of large cooperative efforts to overcome the problems. According to the requirements of the tasks, they can be divided into various components that are organically connected. Cooperation and division of labor should be carried out according to the characteristics of each component, and each should be studied individually, and then the separate results can be joined together to become a whole. Necessary basic research and applied research should be carried out in a coordinated way. The tasks can be completed and science and technology can be developed. This is much better than unilaterally emphasizing basic research or applied research.

The distribution of funds should also be considered on a nation-wide basis. Considering the ratio between basic and applied research from the viewpoint of the Academy of Sciences alone is not overall. The funds for basic research by the Academy of Sciences can be larger. The achievements in basic research will be useful sometime and funding should be more generous. But the proportion of funds for applied research by research academies and institutes in the industrial sector should be larger. Cooperation can be realized only by fully developing their characteristics, otherwise, if the Academy of Sciences also carries out research in technological processes and products, and the industrial departments also engage in the development of products and technological processes, then the Academy of Sciences could be changed to an engineering technology research academy.

The key is to find subjects in production practices and to serve national economic buildup. Both basic research and applied research must surround this goal tightly. A few people can engage in some long-range, high level and theoretical projects. In most situations, they must serve the present buildup of material and spiritual civilization.

There is a tendency in scientific research at present, that is a willingness to carry out projects by oneself but an unwillingness to cooperate. This tendency does not coincide with the socialist spirit of overall cooperation.

In general, scientific research is a creative activity of discovery and invention. It includes understanding the laws of nature and the utilization of these laws to provide materialized productive forces for society and production. It can be divided into basic research and applied research, but they both must serve national economic buildup. Under the prerequisite of not deviating from this goal, we should appropriately arrange the ratio between basic research and applied research. Different research units can emphasize their own subjects, each should acquire a special skill, and then efforts to conduct such research can be organized, and the efforts can be coordinated so that science and technology can develop. In basic research, we should note the needs in application, and applied research must be based on full basic research achievements. We should also pay attention to the transition and the transplanting of research achievements to production and we should solve the problem of popularizing the achievements. The private ownership of production data in capitalist nations determines the isolation and the hermetic nature of research departments. In our socialist system, the boundaries between departments and regions should be broken. Efforts should be organized and connected by cooperation. We must consider the ratio and division of work between basic research and applied research within the realm of the whole nation, otherwise, the Academy of Sciences, the industrial sector, the local factories and mines and the higher educational institutions will all be engaged in the same work. This is unfavorable to developing one's characteristics, and it also hinders the improvement of standards.

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CSO: 4008/9

# NEW WAYS TO REFORM SYSTEM OF SCIENTIFIC RESEARCH EXPLORED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese, No 4, Oct 82 pp 54-56

[Article by Chen Minghu [7115 2494 3471] of the Chongqing City Machinery Research Institute: "Implementation of Joint Production Contracts for Scientific Research and Technology is a New Way To Reform the Scientific Research System"]

[Text] Recently, some scientific research units and factory enterprises in Sichuan signed different forms of technical joint production contracts, pushed forward the development of scientific research and production and realized welcomed results. This is a concrete method of combining scientific research and production. It has opened up a new way to reform the scientific research system.

The joint production contract for scientific research and technology utilizes science and technology to solve key technical problems in industrial production, and it is a way to enable both scientific research and production to clarify their own economic responsibility and economic benefits through joint production contracts.

Technical joint production contracts are generally divided into the following forms:

I. When the higher authorities issue scientific research projects, they sign contracts with the units carrying out the projects for compensatory use of scientific research funds.

This type of contract clearly states the schedule for completion of the scientific research projects, the technical and economic indices to be examined, the total amount of funds provided, the recovery ration of compensatory use of scientific research funds and details of awards for completing the projects before schedule or penalties for delays. At the same time, the supervisory departments of the units carrying out the projects are commissioned to supervise and arbitrate responsibilities during implementation of the contracts. For example: The "medicine container folding machine" development contract signed by the Chongqing City Science Committee and the Chongqing Machinery Research Institute clearly specifies that the time from the issuance of the scientific research task to its completion for evaluation is nine months. After the project is finished, the technical evaluation indices will be: the ability of the folding machine to fold 70 medicine containers a minute with a rejection rate of no more than 5 percent. The total amount of funds provided will be 25,000 yuan. After the machine has passed inspection and begins production, 10 percent of the total amount of scientific research funds shall be paid back to the City Science Committee. If the scientific research task is completed a quarter ahead of schedule or delayed one quarter, an award or a penalty of 5 percent of the total outstanding amount of scientific research funds unpaid shall be levied. If the scientific research task is not completed a year after its scheduled completion date, all scientific research investment funds shall be repaid in full.

The result of doing so is that this can prevent some units from submitting projects just for acquiring funds without really caring about whether the projects can be completed within schedule or not. After implementing such contracts for compensatory use of scientific research funds, science and technology have been tied to economic results and economic responsibility, and methods for awards and penalties have been established, thus the enthusiasm of each sector has been mobilized and this greatly hastened the progress in scientific research.

## II. Scientific Research Units and Factories Signed Technical Joint Production Contracts for Single Projects

There are more varieties of such contracts. Generally there are design contracts, research and development contracts, technical improvement contracts, technical service contracts and technical achievement transfer contracts. Their common characteristics are as follows: In general, the scientific research unit provides the technology, test data or sample machine, the factory provides raw materials, capital, test sites and other testing conditions, and both solve certain key scientific and technical problems together or both carry out trial manufacturing of new products together. The contract clearly specifies the schedule for completion, the required technical and economic goals, the economic responsibility and the economic benefits of both parties.

For example, the Chongqing Nonferrous Metals Research Institute and the Jiangbei Electronic Equipment Plant signed a contract to jointly test manufactured new products. The research institute provided the refrigerating components, and the factory carried out product assembly and testing. After sales, the institute earns 45 percent of the production value and the factory earns 50 percent of the production value. The remaining 5 percent is paid to the administrative bureau of the electronic equipment factory as compensation for supervision, arbitration and coordination work.

The Chongqing Machinery Research Institute signed separate contracts with the Chongqing Spark Plug Factory and the Chongqing Low Pressure Container Factory to design an automatic welding machine for spark plugs and to transfer the technical achievement of the Q103 hydraulic oil press. The contracts stipulated that after the automatic welding machine for spark plugs has been manufactured according to the design blueprints, its rate of production must not be lower than 900 pieces per hour. This is equivalent to 6 times the productive level of the current hand operated welding machine. The factories pay the research institute 7,200 yuan for the design. Because both parties practiced the spirit of friendship and mutual understanding, the institute was willing to build the prototype machine because it felt responsible for assuring quality. During the course of assembly and testing, the blueprint was continually improved and perfected until the design requirements were reached and no additional fees were charged. Under the technical achievement transfer contract, after the Q103 hydraulic oil press developed by the institute passes national evaluation, the whole set of design data and technical documents will be handed over to the factory for batch production. After the products are sold, 4 percent of the sales price per unit will be given to the institute as fee for the transfer of the achievement until 100 units are sold.

## III. Scientific Research Units and Factories Signed Relatively Long-Term Agreements for Technical Joint Ventures

The Carbon Black Industry Research Institute of the Ministry of Chemical Industry and the Zigong Carbon Black Factory signed a long-term technical joint venture agreement for 1981 to 1985 in July, 1980, based on the need to develop advantages and avoid shortcomings and to adapt to the need for an ever increasing number of new products in the market. The agreement stipulates that the Carbon Black Research Institute will provide such new products as the 04 carbon black developed by the institute and the complete set of technical data to the carbon black factory for popularization and utilization. After production of the product begins, the carbon black plant will pay the Carbon Black Research Institute 10 percent of the profits from the sale of the product for two years, balanced once a year. While popularizing new varieties of products, the Carbon Black Research Institute will also provide technical consultation services for the carbon black factory, including information on the newest technology in our nation and abroad, economic activity, treatment of the three wastes, energy conservation measures, factory development planning, new plans for developing potential and renovation, technical problems in production that urgently need to be solved, and new testing methods. Consulting services will charge for costs, design fees and training fees. In this way, it is expected that the output in 1985 will be 2 to 2.5 times that in 1981, and the number of varieties will increase 2 times. The agreement also stipulates that during the course of popularizing and using new products and new technologies, losses due to technology shall be borne by the Carbon Black Research Institute as economic losses. Losses due to other causes shall be borne by the Zigong Carbon Black Plant.

## IV. The Internal Departments of Scientific Research Units or Internal Scientific Research Agencies of Factories or Their Shops Signed Internal Contracts

The Chongqing Machinery Research Institute signed a contract with the Xinan Pharmaceutical Plant No. 3 this February to develop a thermal plastic sealer for pills. The contract requires that the institute must complete testing and deliver the machine to the factory for use in the third quarter of this year. To enable the contract to be carried out smoothly, the institute immediately held a meeting of related departments within the institute. They drew up a new development plan according to the requirements of the contract, clarified the schedule, quality and conditions for awards and penalties. The responsible persons of each department signed their names on the internal agreement as reference for evaluation. This served a very good promotional function in guaranteeing the completion of external contracts.

## V. Enterprises Signed Mutual Technical Contracts

At present, because of the need for national economic adjustment, some professions have taken the expansion of services as the major content of business management work, therefore technical contracts signed between enterprises have become very noteworthy.

For example, in recent years, our province's agriculture, livestock production, sideline production developed relatively greatly, the output of meats, fowl and eggs has increased, therefore, the problem with cold storage has become outstanding. The Chongqing Refrigerator Plant implemented door-to-door technical service, shifted production emphasis to complete sets of cold storage vaults and refrigerators and such equipment, and signed a contract with the Sichuan Provincial Tongliang Cold Storage Vault and such units to manufacture 500-ton cold storage vaults. At present, the facilities have been delivered to the user and the results have been good.

The Chongqing Changjiang Machine Tool Plant developed its technical superiority and signed a contract for technical improvement with the Chongqing Dry Cell Plant. Starting from the beginning of 1981, it continued to test manufacture and produce 25 special dry cell units including the waxing machine for packaging cotton, sizing and wicking machines, paste making machines, four-bar linkage machines and labeling machines. It has done a lot of work to support the Chongqing Dry Cell Plant in technical improvement of whole sets of machinery. It has also supported the improvement of dry cell technology at various localities, provided new technical equipment to develop dry cells popular in the market. The equipment has been welcomed by the dry cell plants in other provinces.

At present, the technical joint production contract system implemented on a trial basis in our province is still mostly in the preliminary form of technical contracts for single projects, but they have already demonstrated many advantages:

### (I) They have promoted the close combination of scientific research and production

In the past, scientific research units simply relied on administrative means to manage scientific research. When the higher authorities issued tasks, the lower echelons bargained, and the problem of "combining" the two major sectors of scientific research and production was never solved well. For a long time, scientific research departments did not understand well the key technical problems in production that needed to be solved urgently, and the production departments did not rely on science and technology well to develop production. Therefore, scientific research development plans did not truly become a component of national economic plans. Now scientific research is directly combined with production units, scientific research units can fully utilize their own superiority and specialties according to domestic and foreign market needs and production needs to arrange scientific research tasks. In this way, the goals of scientific research are clear, the achievements can be utilized in production well, and basically it has changed the past phenomena of regarding scientific research achievements as just "three things," i.e. "samples," "exhibition items" and "gifts."

The direct use of scientific research in production, especially applied projects, has solved some key technical problems that have not been solved for many years by some factories, mines and enterprises, and it has created profound changes in production by these enterprises. Some scientific research achievements have also become the "dominant products" of these factories and enterprises and increased their competitive abilities. Some projects filled the "blanks" in our nation, and created conditions for export and creating foreign exchange. All of these have been acclaimed and welcomed by factories, mines and enterprises.

### (II) They have strengthened the buildup of scientific research units themselves

Take the several applied research institutes in Chongqing as an example: The Chongqing Laser Research Institute signed a contract with the Changhang Dongfeng Shipyard to develop a laser punch. After completion of the project, the work efficiency can be improved 20 times, and according to contract, the factory will pay 20,000 yuan to the institute for the work.

The Chongqing Machinery Research Institute began signing technical joint production contracts in 1979 on a trial basis. Since then, the per capita net income of the whole institute in 1979 reached 190 yuan. In 1980, this increased to over 660 yuan. At the same time, the percentage of completion of projects increased from 57 percent to 82 percent.

The Chongqing Construction Science Research Institute allocated a portion of the net income from last year as monetary awards and mainly used most of the income to strengthen its experimental means, expanded scientific research further, and at present, it has purchased a 500-ton long pillar compressor for pressure tests of large tonnage wall bodies and long pillars.

The above facts show that the implementation of technical joint contracts has changed the past situation of overly tight control. Scientific research work has begun to enliven and the road is becoming wider. Scientific research units have new channels of revenue and this revenue has partially made up the deficiency in funds, increased personal economic income, and mobilized the enthusiasm of the workers. This not only can shorten the period for research and development, it is also beneficial to producing more talent and more achievements, and it can push production forward and become an important new force in promoting the development of potential, renovation and improvement of the factories and enterprises.

At present, in our province, most of the contracts implemented on a trial basis are still preliminary technical joint production contract for single projects. Some localities have already gradually changed towards higher level forms and longer technical joint ventures. We are preparing to gradually enable scientific research units to participate in joint productive ventures for single products of the same profession when the conditions are present so that scientific research units can gradually serve as the scientific and technological center of their own professions. Within a region, the scientific and technical strengths of the scientific research units, the colleges and universities, the factories, mines and enterprises can be organized to shoulder the tasks of solving larger and more important scientific research subjects, join scientific research vertically and laterally to reform and perfect our nation's own scientific research system and open up a new road.

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# PROBLEMS VIEWED IN CURRENT SCIENCE RESEARCH MANAGEMENT

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, Jul 82
pp 1-7

[Article by Lu Jiaxi [4151 0857 6932] of the Chinese Academy of Sciences: "Several Problems Concerning Current Scientific Research Management*"]

## [Text] I. Strengthening Academic Leadership

The fourth membership conference of the academic departments held last May was an important step toward reforming the leadership system and strengthening academic leadership. But in changing from administrative leadership to academic leadership, there is still a lot of work to do. One very important point is to develop academic democracy and strengthen the academic legal system. The democracy and legal system we are talking about share common points with other areas but they are not entirely the same. In our scientific research units, developing democracy and strengthening the legal system mean to reorganize scientific research procedure, improve scientific research management, make regulations and systems sound, create an academic environment, develop discussion between the same professions, enliven the academic atmosphere, and shape a tradition of debate.

In strengthening academic leadership, we must fully develop academic democracy and create a productive academic atmosphere. Facts prove that without academic democracy, there will not be a productive academic atmosphere, and there will be no academic leadership. We have realized through the experience of the past several years that discussion within professions is a good way to develop academic democracy and an important measure to strengthen academic leadership. After the fourth membership conference of the academic departments, we grasped the work of evaluating the research institutes and achieved better results. Doing this enabled scientists to propose constructive opinions concerning major academic problems. The research institutes that were evaluated all felt that this was very helpful and gave us a more profound understanding of how research institutes carry out academic leadership through the evaluation of the research institutes. But, up to the present, each academic department has only evaluated one or two research institutes. The progress of evaluation should be hastened. Each academic department can divide the research institues of its own system into categories, and then select one research institute from each category for evaluation. In this way, one evaluation can solve the problems of several research institutes. Of course, at present, evaluation by colleagues in the same profession is still not perfect. There are still some problems, but evaluation is always better than no evaluation. Through recent work in evaluation by colleagues, including the evaluation of research institutes, the academic atmosphere has become more productive than before. We have succeeded in developing academic democracy and strengthening academic leadership and have pushed scientific research work forward.

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*Editor: This article is an abstract of a speech given by the writer at the Planning Conference of the Chinese Academy of Sciences

Truly to strengthen academic leadership, we must consider problems academically and from a strategic viewpoint; we must change the past way of relying only on administrative meetings to decide problems. For this purpose we must reform current scientific research management methods. Beginning this year, we will change the previous method of managing scientific research funds. One important aspect is to give support by "selecting the important" and "selecting the superior." Giving support by "selecting the superior" means supporting those academic leaders and research subjects that have relatively high academic quality. Giving support by "selecting the important" meaning supporting those research topics that can solve key scientific and technical problems in the national economy and in national defense buildup. "The superior" and "the important" do not exist independently. They must be combined. To select "the superior" and "the important" well, we must rely on strengthening academic leadership and improving the quality of academic leadership. The methods of managing the key subjects supported by the institutes, and "superior" and "important" subjects, must also be changed. In general, we must consider "basing our efforts on success." First, we must have near-term and long-term goals. Second, we must have a definite time limit. In general, the efforts should show results or should be completed within 3 to 5 years. The "frills" that do not produce a result for a dozen years or several decades must not be supported. Of course, "basing efforts on success" or completing efforts within a time limit mainly refers to applied research and developmental work. It is very difficult to require basic research to be completed within a time limit, but we should have plans and arrangements so that progress is realized in each stage and meaningful results are realized (it would be best if the expected results are achieved). If all projects can realize this, then it will prove that the standard of academic leadership has been evaluated. Another innovation in managing scientific research funds is that starting this year, our academy will provide monetary assistance through the Chinese Academy of Sciences Science Fund. This is a fund oriented toward the whole nation. The amount of evaluating work is large. The planned time limits for projects seeking funding should be shortened. Generally, they should be required to produce results within 2 to 3 years. At present, we are studying specific methods of review. The funds for key projects supported by our academy this year amount to 40 million yuan; the science fund has 30 million yuan this year. After gaining experience, we must increase the amount of funds for key projects, increase the proportion of funding and reduce the proportion of contract work to stimulate everyone to think, and solve the problem of "eating from the big pot." Another aspect of renovating scientific research management is that we should change the current method of managing and using large instruments and equipment. We have a lot of equipment that has broken down, not because of use, but because it has been left unused, thus causing great waste. In order to be responsible to the state and fully utilize large instruments and equipment, I believe we should build comprehensive laboratories at some of the institutes that have relatively complete research equipment, not just for use by the institute itself but also for appropriate use by the public, mainly by high-level researchers and visiting scholars who have the knowledge but who lack instruments and equipment. In this way, we can exchange academic ideas, broaden our perspective, and utilize the instruments and equipment very well. An Australian scientific worker took the initiative of requesting to visit our Fujian Institute of Materials Structure to work for a period because he lacked experimental equipment. He had success in his work, for which he was very grateful to us; and we also learned some things from him.

An important task in strengthening academic leadership is to establish a correct policy for scientific development. Otherwise, "selecting the important" and "selecting the superior" cannot be done well. Of course, an overall policy for science cannot be drawn up in 1 or 2 years, but building institutes for specific academic disciplines should be supported. There should be two criteria in selecting the fields to receive the main support. One is the trend of development of science in the world, and the other is the needs of the nation. We should take the needs of the state as urgent tasks. We should center our efforts on the academic departments and invite scientists to draw up a science development policy. We must start from the vertical (the system of each academic department) and the horizontal (the types of committee). We must make effective use of each academic department and pay attention to utilizing bureaus and special committees of the academy and its departments. We must strive to draw up a general outline of science development policy during the first half of this year. With a policy to develop science, it would be easier to determine the projects and academic disciplines to be given key support. In the future, a guide to special project funding and regular funding within the academy should be printed first; otherwise, funding cannot be controlled.

Inflated administrative agencies and rigid bureaucracy are a major hindrance to strengthening academic leadership. The CPC Central Committee and the State Council have already resolved to reorganize and streamline state agencies. Our scientific research units should do the same. The organizations at the academy and institute levels should also be readjusted, reorganized and streamlined, and a job responsibility system should be established at each level to strengthen lateral relationships, improve work efficiency and adapt to the needs of strengthening academic leadership.

How can we measure the level of an organization's academic leadership? I believe we should mainly use the academic level and the academic ideology to measure it. A unit with a high academic leadership level has high academic quality and the subjects are effectively selected. Another standard to measure the level of academic leadership is academic ideology, academic tradition and academic atmosphere. The units with a high level of academic leadership not only have an active academic ideology and a good acaddmic tradition, but also a productive academic atmosphere. We should recognize that these are environments and conditions that produce results and develop talent. Some of our research institutes can in fact produce more results and better results, more and better talent because, among other things, the academic tradition there is good, the atmosphere is productive, their perspective is broad, their thinking is sharp, they can grasp scientific problems accurately and quickly for in-depth research. Professor Kenichi Fukui of the Engineering College of Kyoto University in Japan, who received the Nobel Prize for chemistry in 1981, conducted a lot of research in other aspects of the theory of quantum chemistry; but he received the Nobel Prize for his major achievement in studying molecular orbitals. His achievements resulted from his activity of mind, specialized expertise and broad range of knowledge.

## II. The Problem of Training Talent

The problem of training talent is a fundamental strategic problem. Without superior talent, we cannot produce major achievements. Without superior talent, the scientific academy would not become the "nation's team" and it would not be the center of comprehensive research and the highest academic agency. Because of this, the training of talent must be tightly and forcefully grasped. The main force on the frontline of scientific research at our academy now consists [illegible] middle-aged and young scientific workers. They are our hope. I say this [illegible] to denigrate our scientists of the older generation: our older scientists have made many contributions to the development of our nation's science. But I am talking about the present situation. At present, we must hasten the training of middle-aged and young scientific workers and train a group with superior talent, or a highly trainable group to steadily supplement our academy's scientific research team.

The training of talent requires a skill in "judging horses," an eye for selecting the long distance runners. In the past, when adjusting salaries, giving promotions and evaluating technical skills and jobs, we frequently paid attention only to people "with discoveries, inventions and outstanding contributions" (i.e., people who had made discoveries, inventions and outstanding contributions). These people should be given emphasis, but I believe this is not enough. Those people who have worked with dedication for many decades, who have worked hard, who have occupied and opened up an academic realm and who have continued to make achievements should also be similarly emphasized. We should say that these two kinds of people are both the "long distance runners" needed to develop science. The Nobel Prize is sometimes awarded to people who have made major discoveries during the current year or in recent years, but sometimes it is also awarded to people who have conducted dedicated research in a certain subject for several decades and who have opened up an important academic area and realized major achievements.

In recent years, every sector has paid a lot of attention to selecting top talent. This is correct. Highly talented people who have made outstanding achievements early in life should be discovered in time. Their training should be strengthened so that they can become the vanguard in scientific work. I want to point out emphatically that we should never neglect "late bloomers." In fact, in the history of the world, there are many "late bloomers." Einstein was such a case. He did not get good grades in elementary school and middle school. He did not qualify for the university the first year after he graduated from middle school. But, later, he realized great achievements known throughout the world. People who show bright promise at an early age and "late bloomers" are two different types of people who differ in the time at which they make their achievements. Do they have nothing in common? Of course they do. Their common point is that they possess profound insight, they are very sensitive to new things, and the questions they pose are profound. I believe this should be an important criterion in selecting superior talent. The talent we need should be "all-round talent." But this is very difficult to achieve and therefore we need even more "special talent." It is very difficult to require a person to be expert in everything. I believe that the most impportant aspect of training a talented person is to enable him to persist in one direction in his job so that he can work steadily without changing direction. At the same time, we must enable these people to come into contact with work in some other areas as much as possible; this includes theoretical research and also experimental sciences. When we establish this foundation firmly and broaden knowledge, our perspective will be broadened, and we will be able to realize major achievements.

The Chinese women's volleyball team is the champion of the world. This has strengthened our confidence in training a "national team" in science and technology. One important condition that enabled the women's volleyball team to become the world's champion was the selection of talent at each level. The best talent was selected for the team and the members were given strict training. We should do the same in training a "national team" in science and technology. For this, the higher educational institutions should continuously supply superior talen to our academy. The second is that we must establish several academic centers and training centers by ourselves. The third is that we must strengthen foreign and domestic academic exchange, enliven thinking and develop "hybrid vigor." In addition, like the women's volleyball team, our team must be complete. There must be forward and defensive positions. This means, the various types of talent must be in the appropriate proportion. Necessary organizational and administrative personnel also must be in appropriate proportions.

The source of new scientific researchers of our academy in the future should mainly be graduate students. Therefore, the training of graduate students must be greatly strengthened. Now, some graduate students have an overly limited range of knowledge. They have become too expert in one subject and they can only carry out a very narrow aspect of work. They will not be able to adapt when the work is slightly changed. Such graduate students will not have a bright future for development. For this purpose we can consider establishing an academic center in areas where there are many research institutes, and a training base to carry out overall training of graduate students. At present, I believe that this can be done at least in Beijing and Shanghai. At the same time, we can also consider joint training of graduate students with higher educational institutions, and invite higher educational institutions to conduct basic training and research institutes to conduct specialized training so that graduate students can receive good training in both the fundamentals and in specialization. Our specific research personnel and teachers of higher educational institutions can engage in both research and teaching and can support one another in utilizing instruments and equipment. Our Fujian Materials Structure Institute has joined with Fuzhou University during recent years to train graduates in structural chemistry. Not long ago, I returned to the institute to hold a thesis question-and-answer session. I discovered that the caliber of these graduate students was not bad. I hope that everyone will give more thought to training graduate students and think of more ways to do it.

Another problem is sending students abroad for training. We must admit that this is also a way to train talent. But, first, we must strengthen planning. Second, when we send people abroad, we must consider the working conditions after they return. The year before last when I visited West Germany, I saw the scientific research personnel sent to Professor Ding Zhaozhong [0002 5128 0022] by our academy. They told me that there they were engaged in the most advanced areas, but on their return there would be no equipment in that field and they could only go back to their own work of the past. Such studies abroad thus lose their meaning. Blindly sending people out cannot easily produce high caliber talent. When we send people away to study we must consider their working conditions after they return. Otherwise, even if they acquire advanced knowledge abroad, after their return they cannot develop what they have learned.

Mobility of personnel is also an important question in training talent. Stagnation is very detrimental to scientific research work. Some people enter the research institutes immediately after graduation from the university. They do not even realize any achievements until they become old. In this way, an institute cannot take in that many people. In the United States, after a researcher works at a certain outfit for several years, he will change location. Professors also do the same thing. In this way, both the institutes and the individual can continue to acquire new vitality. Some comrades proposed that scientific research personnel can be reassigned. I feel this is a new idea that can be studied in detail. Generally speaking, we must think of many ways to move personnel about and to enliven the situation.

## III. Develop Our Academy's Superiority and Solve the Problem of Cooperative Studies Well

Wherein lies the superiority of our academy? Some people say it is its multi-disciplinary and varied character. This is correct but not complete. This is because, in the educational system of the Ministry of Education, as a whole, the higher educational institutes have more disciplines than we have. But, in studying new areas, new technology, new materials and new technological processes, our academy is more complete in talent and equipment. It can organize forces to carry out new tasks and new comprehensive research projects at any time. This is our true superiority, and we must correctly recognize it. We must give more consideration to the needs of the state to better develop our superiority.

The trend in scientific and technological development is toward greater integration. Thus we need cooperation among multiple disciplines and coordination of various disciplines. For example, the energy problem cannot be solved by one academic discipline. There must be cooperation between the various fields, whether in basic research, applications research or developmental research. These are all areas where our academy can develop its superiority. We have the strength to develop our academy's superiority and to shoulder the major tasks of the national economy. Of course, we must first select the topics of research well and then consider the problems of organization and coordination. The successful synthesis of tRNA by our academy was achieved during late November of last year. This project was organized in 1968. After readjustment, 6 units cooperated firmly to carry out the project over a course of 13 years. These have been 13 victorious years and also 13 years filled with conflicts. The work was not smooth. The Third Plenary Session of the 11th Party Congress has created a politically stable and united environment. We must not see only the scientific side and forget about the political side. Ideological work must be considered. It is an important aspect that cannot be neglected in carrying out cooperative efforts well.

We must first approve a large number of projects to be carried out and then divide the large projects into a series of small problems. We see that when foreign nations develop nuclear weapons, space technology and such new technologies, they always divide the major subjects into a series of small topics. These small topics include basic research, applied research and developmental research. Thus we must organize many units to carry them out and to complete them within a time limit. For one unit to carry out all these subjects is not possible. If large subjects are not divided into small subjects, and if they are not required to be completed within a time limit, then we can have no scientific management. The use of computers to realize scientific management does not itself have the capability to divide the subjects. We still must rely on the human brain. Scientific workers can have an effect in this area. ONly by dividing projects into small subjects and setting a time limit for their completion can we use the computer in management. It is not possible to carry out one large project smoothly and realize major achievements at once. Small achievements in some small subjects have to be made and accumulated to make major achievements. Only in this way can they have important academic meaning in science or important practical meaning in application. Otherwise, as small subjects alone, they cannot have such a great effect. The academy of sciences has some experience, but not much. We must develop several projects and consider them well. For example, in energy, we can do a lot of work on conservation, improve the rate of utilization of energy resources, develop energy resources, and mine and utilize coal and patroleum. In choosing the projects, we must take into consideration the needs of the state and our strong points. How do we analyze a subject? How do we combine a series of small achievements? This is a new realm that must be learned by scientific workers. It is also a new technique in leadership. Without acquiring such experience, our progress will be limited. It is hoped that some research institutes will first invest some efforts to acquire experience. Large subjects should be divided into small subjects, and they should be studied separately. When work progresses for a certain period, developmental work must catch up. Some comrades have made preliminary suggestions regarding new materials and materials science, in which they have broken these fields down into smaller topics. For example, one area in studying new materials for use as energy resources is "new materials to improve thermalmechanical efficiency." The research topics include: inorganic high temperature structural materials, nitrides, carbides, oxide hardeners, composite materials, metallic high temperature structural materials. The goal is to use them for long periods at temperatures of 1,200 to over 1,400°C. This not only conserves energy, but also creates new resources. Thus we must study the basic scientific problem of screening materials. What is basic research? The United Nations has a unified standard of classification based on the goals of research work. For example, research that does not have a clear goal is called basic research. Research that has a clear goal is called applied research. Broadening the definition further, there must be developmental work before use. For example, the study of differential equations is not necessarily all basic research. We must consider what is being studied. The qualitative theory of differential equations does not have a specific goal and it is basic research. The study of Maxwell's equations in electromagnetic wave theory has a clear goal and is applied research. To understand certain classes of differential equations in order to compile a computer program is developmental work. We still think in terms of the old classification: basic research,applied basic research, applied research, and so on. To avoid confusion, I still distinguish basic research, applied research and developmental work according to the method and means of research. The selection of materials cannot be regarded as basic research, but it undoubtedly includes many basic research subjects. Such subjects should still be studied by research institutes. Another small subject is research in manufacturing processes. For example, it is not simple to produce highly efficient, low-cost powders. We cannot always use old ways; there must be new methods. There is also much basic research that must be carried out first in dealing with phase relationships and phase balance, and in high temperature static pressure processing of powders, we must organize groups to study them. Again, there are also many good projects that are worth considering in energy: for example, comprehensive research in the use of coal to produce methanol and application of this technique, the study of overall agricultural and forest energy resources, and comprehensive research in generation of electricity by the combined combustion gas and steam cycle.

Comrade Zeng Chenggui [2582 0701 1145] is an oceanographer. He has brought about mass production of oceanic life in farms to produce kelp. Our country's output of kelp is now the highest in the world. This is inseparable from the research work carried out by Comrade Zeng Chenggui. He did a lot of work and he regarded the coastal seas as farms. Actually, besides kelp, much has also been achieved in raising mussels, laver and prawns. Zeng has an even greater ambition: to build pastures for aquatic production and to "herd" in the larger oceans. These projects are all good. We have realized great and positive achievements by dividing large projects into small subjects and organizing small achievements into large achievements.

In the present national situation, how should we carry out our scientific research work? Not long ago, Comrade Hu Yaobang told me that scientific workers should delve deeply into three realities to grasp their tasks. One is the reality of scientific theory, i.e. development and trends in science. The second is the reality of modernized production, the production process and prospects for modernization. The third is the reality of nature, i.e. the natural environment and resources. I believe these three points are well taken and are very important. We should take the initiative in seeking out the tasks in the reality of the four modernizations and use these as the starting points in our scientific research work.

Every research institute should have its own characteristics and superiorities, and it is very important to form such characteristics and superiorities. It is not possible to include everything. We must consider maintaining stability in the direction of our own work over a long period, and we should consider improving the standards and the quality. Only in this way can we promote the accumulation of knowledge and the improvement of standards. But maintaining stability is not equal to holding on to one thing without letting go. Sometimes, to adapt to the requirements of the state, we must also change from one research subject to another. A metaphysically stable direction is not right. Carrying out some work in new realms may be greatly beneficial to future research.

I want to remind everyone once again that at the fourth session of the Fifth National People's Congress, Premier Zhao made the following comment concerning the basic policy for developing science and technology: "Our basic policy for developing science and technology is clear. There are many branches of science and technology. They should serve every sector. Basic research must never be weakened, but the key in the development of science and technology should be to serve economic construction, and in particular to help in solving the key problems that can lead to major economic gains in the national economy. The current atsk is to utilize science and technology better so that they can truly become a strong productive force and a great impetus to economic development."

Our academy of sciences has its characteristics and superiorities. We must learn to recognize our superiorities and develop them better to make greater and [illegible] contributions to the nation and to science!

9296
CSO: 4008/21

# COMPREHENSIVE PLANNING, SCIENTIFIC RESEARCH MANAGEMENT REVIEWED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 28-34, 60

[Article by Liang Jiangli [2733 3068 4539]: "Comprehensive Planning and Management of Scientific Research Units*"]

[Text] The function of scientific research management mainly involves planning, organization and control. The form of management is an upward spiral consisting of planning, organization and control. It converts input resources into output.

The management of research academies and institutes can be divided into three levels. The first level includes decisionmaking and establishing general plans. It is the high level managerial level. The second level is the middle management level and it mainly involves drawing up plans and organization. The third level is the implementation level involved with the concrete implementation of plans.

The fundamental task of scientific research management of research academies and institutes is to forecast the trend of development based on trends in modern science and technology, accurately select the goals of scientific and technical research, establish plans for one's onw department and for one's own profession based on the party's principles and policies and state plans, organize one's own plans and implement them, study management systems, train and select scientific and technical personnel, assure sources for funds, materials and laboratory equipment, fully develop currently available scientific research capabilities, obtain the best results at the least price, and serve the modernization of the national economy and national defense.

The objects of modern scientific research management are mostly huge and complex systems. Scientific research management must organically organize three means (man, organization, law) and four subjects (man, money, material, time) before the best management can be implemented.

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*Author's note: Liu Haizhen [0491 3189 2182], He Guoguang [0149 0948 0342], Chen Lan [7115 1526], Zhang Jingyuan [1728 2417 0337] and Cao Nianci [2580 1819 1964] presented many valuable opinions for this article; deputy director Tang Shiji [0781 1102 0679] carefully reviewed it and made some revisions.

The research academies and institutes are a complex scientific research system. They mostly consist of so-called sybsystems, i.e. such departments as scientific research leadership, technical service, material supply, logistical support. The subsystems can be furthere divided into smaller subsystems. To produce more results and more talent, these subsystems must operate in coordination before scientific research capabilities can be unified and coordinated. This requires common criteria for action and common goals, the implementation of comprehensive management, and comprehensive plans to serve this function. With a comprehensive plan and with corresponding diagrams, we can directly view and understand the mutual relationship among progress, materials and funds for scientific research in the entire scientific research process; managerial personnel at each level can easily understand the relationship between the local situation and the overall situation; and the key problems are clear, measures can be taken easily and inspection and examination can be conducted easily. A good comprehensive plan should be progressive, strict, unified and flexible. Whether a comprehensive plan has been drawn up well and executed well is an important indicator of the level of management of a scientific research unit.

## I. The Basis for Drawing Up a Comprehensive Plan

"Comprehensive plan" refers to the plan drawn up around scientific research tasks to balance comprehensively progress in scientific research, the distribution of materials, training of personnel, technical measures, and the means and equipment for research and development.

The criteria for drawing up comprehensive plans is the political line, principles and policies of the party and the state regarding the development of science and technology, state plans, social needs, trends in scientific and technological development, the social results of science and technology, forecasts of the developmental trends in social needs, and scientific research capabilities.

The research subjects we pursue include tasks assigned by the state, contract tasks proposed by the users and stipulated in contracts, tasks selected ourselves, and arranged by ourselves according to the direction stipulated by the academy and institute or in order to satisfy social needs. Regardless of the nature of the tasks, we must prove the worthiness of the tasks and conduct feasibility studies. They must clarify the following:

(1) the source of the task;

(2) the purpose and significance of the development or production to be undertaken;

(3) similar domestic and foreign products, the level of achievement and [illegible];

(4) the output, main technical specifications, the way to realize the task, the product model to be devel[illegible]

(5) the divisions and rate of progress of the development and production stages;

(6) whether there are any key technologies and key equipment and the methods to provide them;

(7) how much technical manpower is needed, how to deal with a lack of such manpower;

(8) whether there are any sources of funds, what are the economic results;

(9) whether there are official agreements and contracts.

As economic management is strengthened, contract tasks will become an important aspect of planning and management. Scientific research contracts are contractual agreements for the research units to provide products and results to society or users. The contract flow process generally involves negotiating and signing contracts, the implementation of contracts, the completion of contracts and final inspection and delivery. A contract is generally of the following types: "research contracts" for research tasks commissioned by external units; "developmental contracts" for developmental tasks commissioned by external units; "transfer of results contracts" to sell scientific research results or to transfer new technology; "technology services contracts" to serve external units, utilizing the institute's instruments, equipment, testing conditions and processing capabilities; "product supply contracts" to provide products to external units; "cooperative contracts" for joint development in cooperation with related units; and "consulting contracts" to provide technical consultation to related units.

In drawing up comprehensive plans, assigned tasks, contract tasks and self-selected tasks must all be considered and arranged on an overall basis.

## II. Several Relationships Must Be Correctly Handled in Drawing Up Comprehensive Plans

### (1) The Relationship Between Needs and Possibilities

The tasks included in the plans must be comprehensively understood. The scientific research capabilities of one's own unit must be analyzed on an overall basis so that the plans are established on a reliable foundation. Some tasks that are needed by the state and by society should be firmly included in the plans when conditions permit. If a research unit does not possess the conditions to perform some tasks, it must actively create the conditions. If one has the conditions to perform some tasks but the users are not defined, the usefulness is not clear, and if the tasks do not have a future for survival, then they should not be included in the plans.

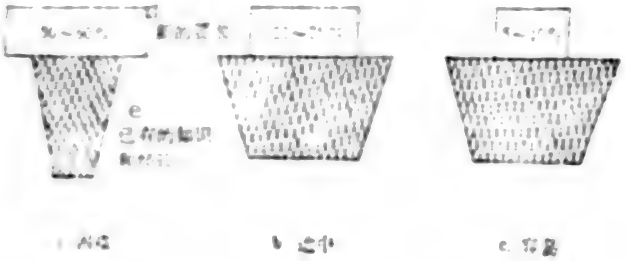
When making arrangement for plans, we must consider input conditions (current capabilities) and output conditions (the goal to be reached). We must grasp the inheritability factor, the investment factor, economic gain and the priority principle. Only in this way can the comprehensive plans thus drawn up truly be feasible.

The inheritability factor refers to the comparison between the experience and knowledge accumulated in the past that can serve as a reference in performing the new assignments, and the new experience and knowledge that have to be initiated. The new experience and knowledge that have to be initiated should be limited within a definite range so that there will not be too many new demands and so that the task can be completed in time. Neither should one be so conservative that there are few, slow, poor-quality, costly results.

In general, there are the following three situations:

Key:

(a) difficult
(b) moderate
(c) easy
(d) new demands
(e) already acquired knowledge
    and experience



In (a), because there are too many new demands, there will be many difficulties in development. We should first arrange research to overcome the technical difficulties and then carry out development. This would be more suitable. If we do not do this, then the large number of technical difficulties will greatly delay the period of development. In (b), new demands constitute only 20 to 25 percent. Developmental plans can be arranged, developmental contracts can be signed with user units, and the task can be completed in time with confidence. In (c), there are fewer new demands, most of the tasks are production-related and easy to complete. Thus a suitable inheritability coefficient (i.e. the comparison between the new task and the knowledge and experience we already possess for completing the task within a specified period) is 75 to 80 percent.

Whether it is possible to complete the newly accepted task is determined by whether we have the investments. If we do not have the investments, we should actively create the conditions. Only in this way can we establish plans on a reliable foundation.

When considering the investment factor, we must also comprehensively weigh it in the light of economic results, social results and scientific value. When arranging scientific research tasks, we should consider the specializations and interests of technical personnel as much as possible. The personnel must be few and skilled. A large number of people would not be beneficial to developing the enthusiasm of various types of personnel and would create difficulties in coordination.

The plans arranged should not be too tightly schedules; neither should they be too loose. When they are scheduled too tightly, a high price may have to be paid. When the schedules in the plans is too loose, they are not conducive to great achievements and to producing a large amount of talent. The percentage of tasks that must be completed should be set at 70 to 80 percent. The remaining 20 to 30 percent can be dynamic: if the task is completed, then the plan will be overfulfilled, if the task is not completed, it would not affect the execution of the entire plan. If we set the number of tasks that must be completed at 100 percent, then even if we have to work overtime and use more work points, it is still possible that the task would not be completed in time.

### (2) The Relationship Between the Whole and the Parts

Scientific research plans constitite the overall situation, and the pasts must serve the whole. The work of the individual offices should be done in this way, and the relationship between the whole and the parts in engineering projects should also be so. Sometimes, problems exist in the parts that affect the realization of the entire plan. This requires conscientious analysis. If the problems presented by the subdivisions are indeed worth considering, we should revise the whole plan by seeking truth from facts.

When drawing up plans, we must handle well the relationship among progress, scientific research funds and material supply. When the schedule is determined, funds and material supplies must be guaranteed. The schedule should not be affected by poor management of funds and materials. If the source of funds is insufficient and material supplies are not guaranteed, we should not blindly establish progress plans. We must establish the schedule on a reliable foundation.

To hasten progress in engineering research and development, we must hasten the rate of material supply; this may even increase expenditure. Therefore, shortening the period of development is not always the best in every situation. In a large system, even if a certain subsystem is completed early, it may not contribute to the entire system. Therefore, we must correctly handle the relationship among the three factors to realize the best results.

### (3) The Relationship Between the Key Points and Ordinary Aspects

When drawing up plans, we must differentiate between ordinary engineering projects and key engineering projects. The principle of arrangement should be "overall arrangement, guaranteeing key points." When funds and materials for ordinary projects and key projects conflict, we must guarantee those for the key projects. But in the key projects, not all jobs are key jobs. We must not emphasize the key points and neglect the arrangement of ordinary tasks. Among the nonkey projects, there are also key problems. If the key problems cannot be solved, the completion of ordinary tasks will be affected. Therefore, nonkey projects may become key projects. Thus, key projects and ordinary projects are not necessarily unchangeable. When drawing up plans, we must handle them appropriately. When arranging the plans, sometimes we will feel that there are many tasks and our technical manpower is insufficient. If this is not handled well, arrangement of some nonkey tasks may not be possible for the planned schedule may be delayed. We have had such an experience. In completing one scientific research task, the percentage of the key technical manpower that truly made a contribution was less than 30 percent. Providing that we provide enough key technical personnel for key tasks, we can arrange the less able personnel for nonkey tasks. This may better develop the function of this portion of technical personnel which would be beneficial to the completion of the entire scientific research task.

### (4) The Relationship Between Long-Range Tasks and Near-Term Tasks

To meet the needs of social development, scientific research units must make intellectual and technical preparations before they can continually expand their fields and their ability to serve socialist construction. When drawing up plans, we cannot just see the near-term projects that easily produce results and that have obvious economic results. We must have a strategic view, use appropriate manpower and definite funds to carry out preliminary research, accumulate knowledge and make technical preparations. In this way, when a new task is assigned, it would be possible to reduce the initial technical requirements to the minimum and decrease the risk factor, and confidence in completing the task will be greater.

For the research academies and institutes mainly engaged in developmental research, it is necessary to have appropriate manpower for applied technical research and to pay attention to using the achievements of basic theoretical research.

### (5) The Relationship Between Progress and Quality

The equipment and products developed by scientific research units must be good in quality and the time of development should be short. In the relationship between quality and progress, quality is foremost. Without quality, the product would not have anyuseful value. At the same time, while guaranteeing quality, we must think of all methods which shorten the time required for scientific research. Especially in relation to national defense products, if we lose time, we lost the opportunity for victory. Quality and progress should be unified.

In drawing up plans, conflicts between quality and progress frequently occur. This requires us to analyze the situation and solve the problem correctly. Under all situations, and regardless of what tasks are arranged, we must follow scientific research procedures. We cannot jump over a certain scientific research procedure. In carrying out some urgent projects, we must complete the task within a short period. When drawing up plans, our emphasis should not be on attempts to eliminate a certain developmental stage. We should actively organize forces, take measures and exert efforts to shorten the time for each stage in developmental procedures and realize the goal of shortening the entire development time. Some scientific research tasks require high quality, while the schedule is not too urgent. When arranging plans, we should organize experienced technical personnel to overcome technical difficulties. We should not arrange to have too many technical personnel too early to carry out ordinary jobs that do not include a lot of research.

### (6) The Relationship Between Strictness and Flexibility

After a scientific research plan is issued, it must be strictly carried out. But because there are many unknown factors in scientific research, when establishing the plans, we must allow a certain flexibility. Subjects of different types must be differentiated in drawing up plans. Plans for research projects that are strongly theoretical must have greater flexibility. The plans for applied technical research projects must have some flexibility. The plans for developmental research type subjects must be strictly executed. We must have not only annual plans, but quarterly plans and monthly plans.

Table 1

Planning and Management Characteristics of Three Types of Scientific Research

| | Basic theory | Applied technology | Developmental research |
|---|---|---|---|
| Rate-of-Progress plan | Great versatility | Some versatility | Strictly controlled |
| Funding plan | Estimate | Budget | Strictly had to (although additional funds are allowed, there must be sufficient reasons) |
| Material plan | Not strict | Not strict | Precise |
| Other Coordinated plans | Requirements | Schedule requirements | Fully guaranteeing the execution of the plans |

Because scientific research plans have uncertainty, there are cases when the plans are not completed. But as long as we handle them conscientiously, we can reduce such ineffective plans to a minimum. Plans generally become ineffective in three ways. One is that the plans become ineffective early, mainly because problems existing at the beginning when the plans were drawn up were not effectively prevented, and although it was known that the plans could not be completed, they were drawn up blindly anyway. The second is that the plans occasionally become ineffective. This situation occurs mostly during the execution of a plan when the key technical team suddenly leaves, or when the key components and devices suddenly malfunction and they can not be replaced within a short period. A third is that a plan becomes ineffective after suffering losses. This mostly occurs during the execution of a plan when the measures taken have not been strong enough and the enthusiasm of the personnel has not been mobilized.

In dealing with ineffectiveness of plans, we must take suitable measures so that the plans have a certain strictness. The measures taken can be divided into temporary measures, adaptive measures, corrective measures and preventive measures. The first rhee types of measures are taken after problems occur during the course of executing the plans. They are passive. When drawing up plans, we must allow as fully as possible for problems that might occur and take preventive measures to reduce the risk of not being able to complete the plans. An ounce of prevention is worth a pound of cure.

## III. Evaluation of Comprehensive Plans

### (1) Scientific Research Plans

These are evaluated in terms of the number of completed projects as a percentage of the total number of projects or the amount of work of the completed projects as a percentage of the total amount of work of all projects.

### (2) Scientific Research Achievement

This refers to the quantity and quality of scientific research achievements, including products, equipment, and theoretical achievements. Scientific results, technical results, economic results and social results of the achievements must be comprehensively evaluated.

### (3) Utilization of the Scientific Working Time

The rate of the actual number of hours of scientific work to the scheduled number of hours of scientific work is used to evaluate the intensity of the work time.

### (4) Material Consumption

Its accuracy, suitability and input and output rates are evaluated.

### (5) Finance and Funds

Implementation of the budget, economic accounting, fluctuations in the cost of projects, and results achieved are examined.

### (6) Training of Personnel

How many people have been trained and have realized achievements, how many technical training courses have been held, what the results are.

(7) Income from Scientific Research

At present, this mainly refers to the income from [illegible] and the net income from disseminating technology, providing services, cooperative processing, training of personnel.

The indices for evaluation of comprehensive plans include the seven subjects above. They do not constitute one goal but many goals. When comparing two scientific research units, it is rare that all seven indices of one unit are better than the seven indices of another unit. Thus, examination of comprehensive plans becomes more complex and difficult. This is actually a problem of evaluating multiple goals. To simplify the examination of comprehensive plans, the many goals can be converted to a single unified and comprehensively measurable goal, and thus we can evaluate the comprehensive plans.

1. The Weighting Method

For n goals $f_1(x)$, $f_2(x)$, ..... $f_n(x)$, we assign corresponding weights $\lambda_1$, $\lambda_2$, ..... $\lambda_n$ according to the importance of the goals. Then we form an evaluation function where x represents different comprehensive plans.

$$F(x) = \sum_{i=1}^{n} \lambda_i f_i(x)$$

Based on such a formula, we assign weights to the 7 indices for examining comprehensive plans according to their importance and stipulate the value of each index. Thus, as long as we know the actual values for 7 indices, we can evaluate the completed tasks of a scientific research unit. The higher the value of the evaluation function F (x), the better the task has been completed.

The weights and standard values stipulated above are standard for similar types of scientific research units. As long as we know the actual values of the 7 indices achieved by different units, we can measure the completed tasks, and units can be compared with each other. Units that have an evaluation function F(x) of a large value are units that have completed the tasks well. If a specific value is not reached, we regard that unit as [illegible] completed its task.

For example, the [illegible] of two different comprehensive plans (respectively represented by x, y) is shown in Table [illegible].

$$\sum [illegible] = [illegible] \times 190 + [illegible] + 0.7 \times [illegible] + 1 \times 80 + 1 \times 30 + 0.5 \times 30 = [illegible]$$

$$\sum [illegible] = [illegible] + 50 + [illegible] + 25 = 293$$

## 2. The Goal Method

We define a new evaluation function

$$U(x) = \sum_{i=1}^{7} [f_i(x) - f_i^*]^2$$

where $f_i$ (x) --the value of actual completion of the ith goal.

$f_i^*$ --the specified standard value of the ith goal.

According to experience, we can stipulate the standard values of the 7 indices for examination. As long as we know the actual value of completion of the 7 indices by a certain scientific research unit, we can know whether that unit has completed its tasks well or not. The smaller the value of the evaluation function U (x), the better the task is completed.

If the actually realized values of a unit are those listed in Table 7, then

$$U(x) = \sum_{i=1}^{7} [f_i(x) - f_i^*]^2 = (38 - 40)^2 + (10 - 15)^2 + (8 - 10)^2$$
$$+ (9 - 10)^2 + (10 - 10)^2 + (8 - 10)^2 + (5 - 5)^2 = 38$$

If for another unit

U (x) = 30

then of course, the one with the evaluation function U (x) = 30 has completed its tasks better than the one with an evaluation function U (x) = 38.

Table 6 Standard Values of Examination Indices

| Evaluation indices | Standard value $f_i^*$ |
|---|---|
| Scientific research plan | 40 |
| Scientific research achievements | 15 |
| Use of time for scientific work | 10 |
| Material consumption | 10 |
| Finances and funds | 10 |
| Training of talent | 10 |
| Scientific research income | [illegible] |

Table 7. Actual Values Evaluation Indices

| Evaluation indices | Actually realized value $I_i(x)$ |
|---|---|
| Scientific research plan | 38 |
| Scientific research achievements | [illegible] |
| Useful time for scientific work | 5 |
| Material consumption | 9 |
| Finances and funds | 16 |
| Training of talent | 8 |
| Scientific research income | 5 |

## II. Organizational Entities

The research institute as a system must have a comprehensive plan. The drawing up of a comprehensive plan requires a comprehensive organization. This organization is a committee by nature and it should have two functions. One is authority and the other is intelligence. Authority means that its decision is legally binding and the relevant sectors must execute it faithfully. Intelligence means gathering together talent from many sectors to form a brain trust to understand the level and trend of development of various industries in our nation and abroad. The brain trust must be able to organize and establish the direction of development and long-range plans for its own system. It must have a definite managerial experience and knowledge and be familiar with new management methods. To carry out these two functions, this committee must admit persons actually responsible for planning, equipment and finances and place them under the direct leadership of the institute director. It should either periodically or occasionally study major problems related to scientific research and production. The decisions made must each be implemented. Within the comprehensive organization, there are only a few actual planning personnel. Most of the other personnel can hold concurrent posts to reduce unnecessary echelons.

The tasks of this organization are:

1. To conduct systematic, comprehensive, analytical research on research tasks and research capabilities, and to propose guiding ideas for drawing up each plan;

2. To be responsible for drawing up long-range plans and comprehensive annual and quarterly plans;

3. To establish a system for analysis of plans; to analyze the various elements comprising the overall system; to summarize and evaluate the processes of scientific research, materials and funds; to propose various plans; to analyze their interrelationships and limiting conditions; to estimate results; to select the best from many plans;

4. To establish an information feedback system to discover problems in carrying out the plans on time, accurately and responsively, to organize their coordinated solution;

5. To organize and gather various kinds of data and information; to make forecasts of orientations and tasks; to propose analytical opinions periodically or occasionally concerning the various aspects of the task and the progress in research and development;

6. To summarize and inspect the various stages of work effectively, and to compile comprehensive statistics and statistics on necessary special topics;

7. To organize exchange of experience and use and disseminate scientific management methods.

Because the work of the comprehensive department affects the entirety of scientific research units, the position of the comprehensive planning department must be elevated objectively.

First, the leadership in charge of scientific research and production must concurrently serve as the leader of that department.

Second, the members of that department must possess the rank of deputy department chief and higher.

Third, the major administrative policies of scientific research units must be proposed by the department affected, while suggestions or reports related to scientific research and production and proposed by other units must be submitted to that department.

Fourth, personnel must be few and skilled, they must be very familiar with the specialization of their own unit, and they must possess rich managerial knowledge.

The comprehensive scientific research plan constitutes the utilization of the systematic and comprehensive principles of management. It will become larger as the scale of scientific research enlarges, the techniques will become more complex, the degree of comprehensiveness will become stronger and it will attract more attention from leaders in scientific research.

[illegible]
CSO: [illegible]

## REFORM OF RESEARCH INSTITUTE SYSTEM IN PRODUCTION DEPARTMENTS STUDIED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 13-[illegible]

[Article by [illegible] [illegible] 1405 7506] and Jiang [illegible] [3068 0689 3564] of the Central Academy of Steel and Iron Research of the Ministry of Metallurgical Industry: "Preliminary Study of Reforming the System of Research Institutes in the Industrial Sector"]

[Text] Since the founding of the nation, as the economy and society have developed, science and technology development have also expanded and a relatively complete research system has been established, including the Chinese Academy of Sciences, higher educational institutions, the research institutes and academies of the industrial sector and research units subordinate to the localities and factories and mines. Each has carried its function of basic research, applied research and developmental research. They have realized a lot of achievements in scientific research and have contributed to the development of the national economy and national defense industries.

The reform of the system of research institutes on the scientific research front has begun by strengthening scientific and technical research by legislation, reorganizing scientific research agencies and scientific [illegible] funds appropriated by the state, and related problems, while [illegible] expanding the autonomy of research institutes at test points. The Chinese Academy of Sciences held its fourth academic departments meeting to discuss the future, tasks and founding principles of the academy. Following the expansion of the autonomy of enterprises, the [illegible] scientific and technical research work of factories, mines and other enterprises has been clarified and work has developed more quickly. The research academies and institutes of the industrial sector are facing new problems related to readjustment and reform which urgently need to be solved.

The research academies and institutes of the industrial sector mostly are directly subordinate to the various ministries of the State Council [illegible]. Most of the scientific research tasks come from the [illegible] and commissions or tasks given to the ministries [illegible] higher [illegible] decisions by other departments and handed down. These [illegible] small funds for "three projects" and capital construction funds. In the past, administrative methods were [illegible] scientific [illegible]

[illegible] the research academies and institutes of the industrial sector were [illegible]

[illegible] industrial sector. [illegible] . [illegible] productive. [illegible] scientific [illegible] facilities resulting [illegible] quarters are [illegible], half [illegible] are heavy, [illegible] the distribution [illegible]

[illegible] of the industrial [illegible] management. [illegible] industrial sector [illegible] discussion. In [illegible] engineering. [illegible] and return [illegible] scientific research [illegible] activity.

[illegible] research and/or and [illegible] organizations, that have been [illegible] scientific research [illegible] information gathering, [illegible] testing and safety [illegible] industries and [illegible] that are more strongly [illegible] research and [illegible] or has not [illegible] because the scope [illegible] are centralized [illegible] preliminary research [illegible] production. [illegible] can be made [illegible] and be jointly [illegible] and [illegible] and operation, [illegible] companies [illegible] annual [illegible] research [illegible] Central Board [illegible]

[illegible] that they [illegible]

[illegible] they have [illegible]

the [illegible] of [illegible] rapidly change. [illegible] within our [illegible] are not willing [illegible] require a long [illegible] to bear. In addition [illegible] scientific research [illegible] product quality, [illegible] of basic technical research [illegible].

(III) We must organize the popularization [illegible] well. The popularization of scientific [illegible] point and the type of scientific research [illegible] application of scientific research [illegible] construction. Popularization is the most important link [illegible] scientific research [illegible]. The degree of [illegible] scientific [illegible] the popularization of technical research [illegible]. [illegible] research [illegible] popularization depends [illegible] additional [illegible] used in the [illegible].

There are several situations concerning [illegible]: One, the projects [illegible] are new [illegible] concentrated comprehensive research, [illegible] a new product that is supplied in [illegible]. [illegible] the popularization of achievements is [illegible] this new product. The second [illegible] research. [illegible] of research [illegible] technology, of the [illegible] results in the application [illegible] materials, [illegible] ......[illegible] popularization of achievements [illegible] two aspects depends [illegible] production by [illegible] the popularization. The third is the [illegible] research, such as the [illegible] of new [illegible] technology. This involves [illegible] in-depth research [illegible] popularization [illegible] economic [illegible] social [illegible].

To establish the [illegible] of scientific [illegible] research, we should consider the question of [illegible] organization. [illegible] that the popularization as a complete [illegible] of [illegible] production, [illegible] popularization [illegible] that [illegible] and [illegible].

popularization of scientific research achievements must be broad, fast and complete. The larger the area of popularization of achievements, the faster, the more [illegible], the greater their function in national economic building and the higher their economic value and results.

Ministerial and bureau leading units and related state agencies should all establish specialized agencies to be responsible for guiding the popularization of scientific research achievements and for organizing work.

(VI) We should strengthen management and leadership in scientific research. This includes national management and leadership, and also includes the management and leadership in scientific research units of industrial sectors. On these aspects, I would like to talk about my personal views regarding the question of understanding scientific research as a productive force, understanding the laws of scientific research management and selecting leaders.

Scientific research as a productive force is different from a factory. In a factory, as long as all conditions for production are present, as long as the workers work on the equipment, products can be produced. Scientific research is different. Achievements cannot be realized simply because scientific research conditions are present. Even if scientific research achievements have been realized, if they cannot be popularized and applied in production, scientific research cannot be said to have served as a productive force. The same products can be repeatedly produced. Scientific research projects cannot be repeatedly carried out. Redundancy is waste. Therefore, scientific research is a completely creative and exploratory intellectual labor. The randomness and [illegible] in work are greater. Improper selection of the topics, an unsuitable road in scientific research, insufficient efforts to popularize achievements etc. will all create a waste of manpower, materials and money and all efforts will be wasted. Scientific research also does not have fixed quotas like production which can be statistically [illegible]. It is entirely established on the basis of the self awareness of scientific research personnel. Therefore, scientific research, as a productive force, is more difficult to take than industrial production. If it is not done well, it will have to be abandoned half way, and then all previous efforts may be lost. Cases in which achievements could not be realized for years and months frequently occur. If we do not understand this characteristic of scientific research as a productive force, we cannot [illegible] management and leadership in scientific research.

Because scientific research has these basic characteristics, therefore, management and leadership in scientific research must follow the special laws of scientific research before they can better produce achievements and talent. The characteristics of the work of scientific research units are mainly [illegible]: One is the requirements made upon scientific research personnel. The exploratory nature of scientific research subjects requires that they must possess a rich specialized knowledge, a higher ability to analyze and judge, and a stubborn spirit of struggle. In work, one is required to develop the greatest subjective mobility and he must possess the ideological style of "daring to do large things" and "being strict about three things." The second is that the requirement for planned management must be high. Planned management requires determining the accuracy of the scientific research topic, the completeness of scientific research work, the timeliness of coordination and cooperation in the course of research, coordination in arranging new and old topics, and organizational strictness in popularizing scientific research achievements, etc. Poor management will prolong the time of scientific research, waste technical strength and time, and even waste all efforts. The third is that the requirement for logistics must be high. The subjects of research units are different, the requirements for materials, equipment and instruments are completely different. When old subjects are completed, new subjects begin. The conditions also change, and in particular, the varieties of materials required are many but the quantities are few, and they must be supplied in time. Slight inappropriate arrangement will hold up scientific research because of poor organization. The fourth is that there must be an understanding of the importance of information work. Information work is called the eyes of scientific research. It serves a very important function in hastening scientific research, broadening thoughts, improving scientific research personnel. Different scientific research units also have different characteristics. These characteristics make higher demands upon scientific research management and leadership. They require corresponding scientific management talent and leadership talent. The entire scientific research process is an organically linked whole. Work efficiency and accuracy are the principles commonly obeyed in all aspects of work. A lag in any link of work will affect progress and the realization of achievements.

To enable scientific research to precede production, we must strengthen scientific research, change the backward situation in scientific research, and we must conscientiously readjust the leading groups of scientific research units. We must select those comrades who understand scientific research work, who are strongly entrepreneurial, who have specialized knowledge and who have organizational and leadership talent, who are skilled at uniting scientific research personnel, who have a definite political level, and who have a profound political style to serve as leaders. Without a strong and forceful leadership, it is not possible to fully mobilize the enthusiasm of scientific research personnel, and it is not possible to fully develop the function of scientific research as a productive force.

As long as the several aspects discussed above are emphasized by the state, the ministries and bureaus, the scientific research units, and as long as they are concretely implemented, I believe the backwardness of the products of our nation's machinery industry will quickly change.

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CSO: 4008/74

## SUGGESTIONS FOR IMPROVED RESEARCH COORDINATION ADVANCED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 20 Sep 82 pp 27-29

[Article by Wu [illegible] [0566 1694 3341] and Jin [illegible] [6855 1321 6892], Shanghai Institute of Silicates: "Five Suggestions for Strengthening Organizational Coordination and Decreasing Duplication of Research Topics"]

[Text] The great harm of extensive duplication of scientific research topics is already quite apparent to all scientific research management cadres. In readjusting scientific research work and improving research management, we must begin by conscientiously studying and resolving this problem. Below for reference, we propose five suggestions on the basis of circumstances encountered in practical experience.

### 1. Establish a Top-Level National Coordinating Organization Focusing on Cooperation and Division of Labor in Major Projects

The development of modern science and technology has already passed from research by individual scientists into large-scale research coordinated by national or international organizations. Dispersion, duplication, and one-man efforts are no longer suitable. Accordingly we suggest that the State Scientific and Technical Commission or the cognizant departments of the "main forces" select certain topics of major significance to the national economy and the people's livelihood, involving many departments, in which there is much duplication, such as large-scale integrated circuits, lasers, and optical communications; and establish specialized coordinating groups for them; these groups would survey and analyze the foreign and domestic situation, break up each large project into a certain number of topics, then carry out negotiations and divide up the topics among the units in accordance with their specific characteristics. Each such group would hold an annual information interchange and work conference, evaluate the research work of the individual units, and propose funds distribution programs or proportionalities for the next year. It would institute unified guidance and unified command, eliminate duplication of work by several research units, and concentrate the use of human, material and financial resources.

The great multitude of scientific and technical personnel approve and support this type of specialized, unified management and coordination. In [illegible] vehicles, [illegible] were [illegible] basic materials, [illegible] at that time it was impossible to make [illegible] effort [illegible] scientific workers [illegible] suggested that there should be a [illegible] department to organize and coordinate [illegible] would not be solved. After 10 years, in April [illegible], a coordination meeting was held in Shanghai. [illegible] scientific research work [illegible] to coordinate division of labor.

2. Handle Correctly the Relationship Between Key Topics and General Work, and Prevent the [illegible] from All Climbing on the Key Topics, Resulting in Duplication and Waste

In the past, we strongly stressed breakthroughs in key areas and concentratedly supported projects in these key areas, providing particularly large sums for operating expenses and assuring material support. As a result, scientific research personnel all liked to work in these key areas. The non-key topics did not receive sufficient support and it was difficult to proceed with them. But key work and general work are in a dialectical relationship, and [illegible] non-key topics may suddenly emerge as key topics: this has been a frequent phenomenon in the history of science and technology. In order to develop science and technology comprehensively and to avoid duplication resulting from competition to work on the key topics, we suggest that the State Scientific and Technical Commission and the "five main forces"* publish [illegible] summaries of key research annually in accordance with our country's scientific development plan and in keeping with the needs of national economic and national defense development. After these summaries are published, the scientific and technical personnel of the various fields and units would apply for topics from them. The cognizant departments would [illegible] these applications, organize experts to evaluate them, and select the units which had the necessary specialties, which offered a good overall [illegible], which proposed a reasonable [illegible] and which would have [illegible] the key topics [illegible] of research [illegible]. The unit which was assigned [illegible] topic [illegible] report to the organization [illegible] the topic [illegible], and the assigning organization would [illegible] on the basis of the work report and [illegible]. If [illegible] for several years, the [illegible] and the work assigned to another organization.

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*The Chinese Academy of Sciences, [illegible] the universities and colleges, the ministries and commissions, and [illegible] are generally called the "five main forces."

### [illegible] Division of Labor and Cooperation Between the "Five Main Scientific Research Forces" in Order to Utilize the Strong Points of Each [illegible]

A [illegible] division of labor among the "five main forces" should [illegible], [illegible] these forces [illegible] "regular forces" and "[illegible]," forces such as "[illegible]" and other forces [illegible] "[illegible]," and the [illegible] must be brought [illegible].

Effective [illegible] of the "five [illegible]" will require strengthened, centralized management, [illegible] state research funds concentrated on nationally [illegible]. This country's scientific research capabilities are weak and we are investigating difficult new technologies and [illegible]; if we do not [illegible] the entire country's scientific research [illegible] and institute division of labor and coordination [illegible] joint efforts, it will be difficult to achieve results.

[illegible] should establish an authoritative centralized leadership organization which [illegible] departments and regions [illegible] effective overall planning and coordination in all fields nationwide so as to avoid unnecessary duplication and [illegible] a rationally distributed, complete, in-depth scientific research system.

[illegible] the various "forces" must carry on effective internal [illegible] their systems are all rather large. For example, the [illegible] has five [illegible] and more than 100 research institutes, and there [illegible] between divisions and between institutes; in the past there was very little coordination work [illegible]. The fourth [illegible] of the divisional committees has [illegible] been victoriously concluded, and the leadership forces of both the [illegible] and its [illegible] have been greatly strengthened; and we hope that scientific research coordination will be placed on the agenda of the [illegible] Academy of Sciences, setting an example for the other "[illegible]."

### [illegible] Order [illegible] Eliminate Dispersion [illegible]

In connection with the drafting of the scientific research plan for the [illegible] Five-Year Plan period, all research institutes should conduct a [illegible] ordering of their existing research topics. They should conscientiously analyze the reasons for continuation of [illegible], duplicated, [illegible]; topics that are in accord with each institute's research orientation, whose research has already struck root in a positive direction, which are [illegible] position in domestic [illegible], should be [illegible] the [illegible]; [illegible] those which are not in [illegible] institute's research [illegible], [illegible] a low [illegible] work [illegible] organizations [illegible] should [illegible]. [illegible] deal with [illegible], [illegible] research [illegible] institute should [illegible] while [illegible] particular [illegible] the [illegible] resistance to [illegible] research [illegible] some scientific and technical [illegible] that have [illegible] this leadership and research management [illegible] consider [illegible] must be [illegible] justment [illegible] and to [illegible] in the past [illegible] organization [illegible] national [illegible] fashion. But [illegible] of persuasion, [illegible] evaluation [illegible] other [illegible] requiring the investigation and [illegible] a [illegible] strengthen [illegible] out effectively and [illegible]

[illegible]

Scientific research [illegible] the amount [illegible] workers [illegible] and [illegible]

In the last [illegible] intermediate [illegible] in the [illegible] the [illegible] between [illegible]

[illegible]

[illegible] would be made more [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] fertilizer [illegible] the application and [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

However, there is still a public problem. [illegible]

[illegible]

[illegible]

## QIAN XUESEN ON THE QUESTION OF INTELLECTUALS

Shanghai [illegible] in Chinese [illegible] p [illegible]

[Text] At the NPC discussion meeting, National People's Congress deputy Qian Xuesen [6929 1331 2773] made a statement on the question of intellectuals. He said that he was very encouraged by what was made clear by the 12th Party Congress, the draft constitutional reform deliberated on by this session, and by the discussion of Premier Zhao Ziyang's [6392 [illegible]] report concerning intellectuals. He said that to clearly define intellectuals as a component of the working class, as one of the three basic social forces in building modern society, is an extraordinary matter and a difficult one as well.

### This Is the Glory of the Chinese Intellectuals

He said: "Since ancient times, intellectuals have been a small minority; but they have developed until today they constitute a tremendous contingent. Until now they have relied upon and served the ruling classes. China's intellectuals have been the same. Today, China's intellectuals have moved from their old path in the old society to a new road; they are marching together with the workers and peasants, creating a great historical transformation. This is the glory of the Chinese intellectuals."

### The "Left" Ideological Tendency Cannot Be [illegible]

Qian Xuesen said that there may be some in society who do not completely understand our being regarded as a part of the working class, as one of the three basic forces. As intellectuals, we should not blame others, for the influence of several thousands of years of the old society, and in particular the "left" ideological influence, prevalent during the "Great Cultural Revolution" of despising science and disdaining intellectuals, cannot be quickly eliminated. This means that understanding has frequently lagged behind reality.

### [illegible] Intellectuals [illegible]

We have [illegible] intellectuals [illegible] and [illegible] are truly intellectual [illegible]. "We are deeply moved by their [illegible] we must definitely learn from them. But at

This time we [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] statistical themes which are contained [illegible]

# PERSONNEL REQUIREMENTS FOR MODERNIZED MANAGEMENT STUDIED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, July 82 pp 7-12

[Article by Guan Xipu [7070 6007 2528] and He Zhongxiu [0149 6945 4423] of Kexuexue Yu Keji Guanli [Scienology and Science and Technology Management] Magazine, Tianjin: "On Modern Scientific Management and Its Requirements for Management Personnel"]

[Text] Modernization requires modernized management. Modern scientific management has been regarded as a new element in the composition of modern social productivity. It is an indispensable pillar in modernization. Over the past several decades, especially after World War II, foreign management scholars have published many papers on modern scientific management. Many of them are worth understanding. But the theoretical viewpoints are sometimes not scientific enough, and not all management methods proposed are generalized. To improve the standard of management personnel at all levels in our nation, we must learn from and refer to foreign experience, while at the same time we must do the fundamental work well by combining the principles of Marxism, the principles of socialism and our nation's actual situation. This article is an attempt to explore the actual content, main principles and basic methods of modern scientific management and the logical relations among the three, the requirements they place upon managers, and fundamental management ideas.

## I. The Actual Content of Modern Scientific Management

Correctly recognizing the actual content of modern scientific management is a prerequisite to determining management principles correctly and selecting management methods. When domestic and foreign management scholars talk about scientific management in terms of the objects of management, the management process, the goals of management and the characteristics of modern management, they touch upon this question to varying degrees. But their understanding has been rather one-sided or has not been clear enough. We still need to provide scientific answers based on the actual situation in modern management work and relevant Marxist principles.

Combining theory and practice, analyzing the objects, processes and goals of modern management in detail and generalizing the common features provide us with the following understanding: The most fundamental aspect of modern scientific management is the optimum control of the process of unified movement of systems, people and values. Systems are the objectives of management. People are the objects and the motive force of management, and increasing value is the goal of management. People, who perform concurrently the functions of effectively controlling the unified and coordinated movement of theobjects, motive forces and the goals and of embodying the actual substance of modern scientific management, are the core of this course of unified movement.

(1) The Components of the Objects of Management

Earlier management theory believed that the three main components were people, money and materials. Later, some people added information and time to make five major elements. Recently, some people added morale and method to make seven major elements. The continuing increase in the number of elements reflects recent development of the objects of management and shows that management is becoming more complex; it also reflects the elevation of the standards of modern management science. This is undoubtedly a good thing. But, these perceptions and expressions all have the faults of being isolated, mechanically arranged, and biased. They have not been able to further reveal the organic relationships between the various elements of the objects of management.

If we consider all of the components as a unity, we will discover that the object of management is not simply the sum of isolated elements, but a unification of the whole, the parts, mutual relationships, and variations and transformations of relationships. What is this object that unifies the whole and the part; mutual relationships, and variations and transformations of relations? It is the system! It is the "dynamic system" that is recognized by modern science! This advances the metaphysical understanding of management to a dialectic understanding, from a static understanding to a dynamic understanding, from an understanding mainly of the specific material to an understanding of the variations and transformations of mutual relationships. Such an understanding of the object of management is a step forward in understanding, while at the same time it coincides more with the actual developing situation. If modern management workers cannot dialectically and comprehensively grasp the object of management, it will be difficult for them to meet the requirements of modern scientific management.

(2) The Core or Motive Force of Management

There are different views, based on different approaches. People often compare the different elements of the object of management to the different links in the management process (determining goals, drawing up plans, organizing forces, commanding action, adjusting relationships, controlling systems). They believe that the element or link that is the most important and that can influence the overall situation the most should be regarded as the core or motive force of management. This comparative method is right. But because people's viewpoints are different, different conclusions are drawn. For example, many management scholars in capitalist nations believe money is the core of management and also the motive force in management. Of course, it is the goal of management. There are others who believe the core or motive force of management should be "the flow of information." Henry H. Albers, author of "Principles of Management: A Modern Approach" emphasizes information and decisionmaking. There are also different views on this question. Some emphasize decisionmaking, some emphasize planning, and some emphasize goals. Each has his own views. A representative of modern Western management science, 1978 Nobel prize winner in economics, H.A. Simon, believes that the entire management process is a decisionmaking process; obviously, he also emphasizes decisionmaking.

We believe that when we use the method of comparison to analyze and understand the core or motive force in management, we must be guided by the scientific viewpoint of Marxism. The result of doing so enable us to come to the following conclusion: The core or motive force of modern scientific management should be people. This does not negate the importance of information, decisionmaking, goals, planning, etc- but it correctly states that regardless of whether from the viewpoint of the whole or part of the object of management, or from the viewpoint of each of the links in the management process, management works and performs its functions only through man's action. This is consistent with the principles of historical materialism. Management work is social behavior. The main component of society is man. All social activities are human activities. Therefore only man can be the true core and motive force in management work. If management workers in a socialist nation cannot correctly recognize and firmly grasp this core and motive force, it will be very difficult to carry out modern scientific management work well.

### (3) The Goals of Scientific Management

Scholars of capitalist nations generally describe the goal of scientific management as improving labor and work efficiency. Of course some people have described it more theoretically, saying that it is the unification of the functions of the parts of the object of management and the amplification of the whole so that the function of the whole is larger than the sum of its parts. Many comrades in our nation accept this theory. We also believe this theory has some truth to it. But this to seemingly incontrovertible approach does not expose the final goal of management work. Obviously, the real purpose of improving efficiency in capitalism is only to increase profits for the bourgeoisie. Although socialist nations must also consider profits, increasing profits must never be said to be the fundamental purpose of improving management efficiency. According to the principles of Marxism and the principles of socialism, the fundamental purpose of carrying out scientific management and improving labor and work efficiency in a socialist nation is and must necessarily be to increase and improve the value created by the object of management (including the numerical value and the value rate); it should be the unification of economic and social value. The unification of economic and social value requires that when there is a conflict between economic benefits and social benefits, social benefits should be served. There are indeed such cases: Improvements in management efficiency frequently will be beneficial in realizing short-sighted and partial economic benefits but may not be favorable to and even may be harmful to social benefits. This, is not consistent with the fundamental goals of modern scientific management. For example, uncontrolled cutting of forests destroys the ecological balance, increases production and seriously pollutes the environment, etc.

### (4) Modern Scientific Management Is in Essence a Coordinated Process To Stimulate Manpower, Control Systems and Produce Value

Correctly recognizing the nature of management helps one deepen one's understanding of the following characteristics of modern scientific management: (1) It is not just the organic combination of managing the whole and the parts, it is also an organic combination of dynamic management and static management, i.e., the parts must serve the whole. The relationships between the objects of management, the movement, variation and transformations of the relationships must be emphasized. Effective information feedback circuits within the system must always be maintained and the responsive flow of information and feedback that should exist between one system and other related systems must be maintained. (2) It is an organic combination of managing people and managing materials, and it should mainly involve managing people, i.e., management of other aspects must be driven by mobilizing the enthusiasm and creatively of people. (3) It is an organic combination of economic goals and social goals in which the social goals are the main goals, i.e., economic goals must be subordinate to social goals. Grasping these characteristics of modern scientific management will greatly benefit us in overcoming mechanical, stereotyped, sluggish thinking and methods in management work.

We believe that the above points are the basic understanding of modern scientific management that one should possess. This fundamental understanding makes it easier to explore what major principles should be followed and what basic methods should be pursued in modern scientific management.

## II. The Main Principles and Basic Methods of Modern Scientific Management

### (1) Management Principles are Determined by the Nature of Management

The nature of modern scientific management is the unified action of the three main elements, the system, people and value. Correspondingly, there are also three major principles in modern scientific management, i.e., the systems principle, the "humanistic" principle and the value principle.

The systems principle in scientific management requires management worker to realize that the object of one's msnagement effort is a whole system, and that the parts should be therefore treated with a reference to the whole and should serve the whole. At the same time, they must also recognize that the whole as managed by oneself is only a component of a larger system, so that one must also consider the larger whole and position one's own management system so that it can serve the large system. In our insistence on the systems principle we must oppose separation, isolation, one-sidedness, and "failing to see the forst for the trees" in considering and carrying out various management tasks. Management that violates the systems principle will never become true scientific management.

The "humanistic" principle in scientific management requires management workers to regard the adjustment, control and management of human behavior as the center and the key in managing the entire system well, to regard mobilization of the enthusiasm and creativity of people as the fundamental factors in carrying out the entire management task well, and to recognize that in order to manage money, materials, information, time and the like well, one must first develop people's enthusiasm before this can be achieved. In insisting on this "humanistic" principle we must oppose and prevent the mistaken concept of considering materials but not people, and the belief that "things can be done when there is money." Management that violates "humanistic" principle is not true scientific management.

The value principle in scientific management requires management workers to remember that the fundamental goal of management is to create value for society in the optimum way. Management can create social value. Management that cannot create economic value and social value in the optimum way is ineffective management and constitutes dereliction of management's duty: even when one is very busy, he is still an ineffective manager who has neglected his duty. In insisting on the value principle we must oppose the so-called "leaders in principle" who only talk about "motives" but not results; we must also oppose and prevent routinism, being busy in blind pursuits. We must oppose and prevent extravagance. Management that violates this value principle will never be true scientific management.

### (2) Correspondingly, Modern Scientific Management Has Three Basic Methods That Are Universally Applicable: the System Method, the Behavioral Method and the Value Method

The system method is the scientific method that extends the objective laws of systems of things as principles of thought for handling situations and solving problems. It is closely related to systems theory and systems engineering, but it is not entirely the same. Systems theory is the theoretical science that studies the structure, system, straitification and laws of movement of objective things. Systems engineering is the quantitative, programmed, technical application of systems methods in various types of engineering projects; it is an engineering technique. Every manager must have some knowledge of systems theory and systems engineering, but he does not have to be directly involved in quantitative calculations and technical operations. This is because the manager is actually the organizer and the "leader" (not necessarily having a positional title as a leader) at various different functional levels. Therefore, it is more important that he skillfully grasp the system method. The systematic method as it relates to effective management is a unified process consisting of the following links: 1. viewing the overall system (the whole); 2. resolving the structure (part); 3. recognizing the relationships; 4. separating the strata; 5. tracing changes; 6. adjusting feedback; 7. controlling the direction; 8. realizing the goal. These important points cannot be separated; they must be utilized in unified fashion. There is a single idea running through and connecting these points. It is the recognition, adjustment and control of the various relationships in the system. This is the most fundamental method of thought and work of the modern scientific management worker. To the people accustomed to the method of management of small production and handicraft industries, this method is complicated and variable and seems to be difficult to grasp. But as long as this point is constantly kept in mind, continuously and conscientiously studied, and used, the systematic method is not difficult to grasp.

The behavioral method corresponds to the "humanistic" principle of management. Because mobilizing the enthusiasm of personnel at each level and of all types of people is the basis for doing management work well, how to scientifically manage the behavior of subordinates is a key problem. The behavioral method is a method of scientific analysis of the behavior of various types of personnel and a method of effective management of one's own subjects of management. At present, most of the books on behavioral management we have seen are foreign publications or books that introduce foreign methods. They mainly study the following: First, they study ways to control behavioral motives by analyzing human "needs." Second, they study the principles of behavioral management and methods that can be used. In the Marxist view, this type of study starts out from [illegible] psychology to analyze the different objective needs of various types of personnel, study the different motives that produce the various types of behavior to satisfy different needs, and propose the use of various psychological laws and corresponding methods to manage the behavior of different types of personnel. It holds that the purpose of the behavioral method is to stimulate the enthusiasm of the various types of personnel. These laws indeed have a scientific basis. The many methods based on them have objectively realized many results. We should not negate them lightly. But, it seems that these theories are filled with bourgeois theory of human nature, poisonous supra-class dogmatism, and support for individualism and utilitarianism. Also, they emphasize the behavioral psychology of the individual and methods of its management and slight or ignore the behavioral psychology of the collective and society and methods of its management. Some people even study "collective behavior," but the study is limited to small collectives and starts out from the [illegible] standpoint of "how to control" them. Thus, we must utilize the position, viewpoint and method of Marxism to carry out objective analysis, take the rational inner core and to discard the outer shell, and create, develop and establish our own behavioral management science.

In fact, we have accumulated successful practical experience in our own application of behavioral methods, but we have not systematically and theoretically summarized such experience. The task of theoretically summarizing [illegible] be done by borrowing the positive elements in foreign behavioral management studies, basing such experience on our own ideological and political work and the experience of democratic business management, and combining the experience with the actual situation in our nation's construction has already been included in the daily agenda, and the responsibility has fallen on our shoulders. In our socialist nation, the fundamental purpose of using behavioral methods in scientific management is to mobilize, consolidate and develop the socialist enthusiasm of the people to the maximum extent. To realize this goal, we believe, there are at least three "guidelines" that must be emphasized:

(1) We Must Satisfy the Proper, Rational Objective Material and Spiritual Needs of Our Own Subordinates. We dialectical materialists should recognize that everyone has his own objective needs. Managers should exert all possible efforts to meet all rational and satisfiable material and spiritual needs. This is the fundamental prerequisite in mobilizing the people's socialist labor enthusiasm, and it is also the fundamental goal in carrying out socialist revolution and construction. In a socialist nation, the following four needs should be the proper, rational and most basic objective material and spiritual needs of the whole people: truly receiving more for more work, not just in name only; respecting the honor of being masters of the nation; comradeship and organizational warmth; encouragement of aggressive revolutionary behavior. Only by satisfying these needs can we truly mobilize and stimulate their enthusiasm, initiative and creativity. Here we emphasize "truly," i.e., we must have practical and reliable measures, not ordinary campaigns. Thus we must concretely oppose and conscientiously overcome the following in management work: the egalitarian view that doing more and doing less are the same and that doing well and doing poorly are the same; lofty bureaucratism and privilege that is seriously divorced from the masses; extreme leftist ideological tendencies of putting labels on others, striking with the stick, capitalizing on others, exaggeration, and the narrow and jealous mentality of not being able to accept other peoples being outstanding. Otherwise, the managers and those being managed will not be in tune, and everyone's conscious enthusiasm cannot be mobilized. Wihtout people's conscious enthusiasm, the smooth development of the socialist cause would be impossible to imagine. This is a major problem of principle, and every manager must accord it due importance.

(2) Everyone Must Have Concrete Duties That Are Specified and That Can Be Evaluated.

Implementing a rational job responsibility systems is the key to doing modern scientific management work well. Every production activity, enterprise and service must implement a responsibility system that suits its own situation, and responsibility must be specified down to the individual. This is a fundamental requirement when production responsibility systems were implemented broadly in our countryside, agriculture progressed quickly. Our nation's industrial enterprises are also testing and exploring the economic responsibility system. When it is effectively implemented, industry will also quickly progress. In scientific and technical endeavors, although the situation is more special and complicated, the responsibility system is still the requirement of objective laws, and it must be implemented. Of course, the actual method of implementation still needs to be actively and carefully explored in practice and summarized by everyone.

(3) Everyone's Responsibility Must Be Conscientiously "Inspected." This means that the efficiency and results of everyone's work must be strictly, conscientiously and clearly examined and evaluated, and the person should receive appropriate awards or punishment according to regulations. This is an important aspect of the use of the behavioral management method in scientific management. Without this link, we will not be able to implement the "needs" and "duties" described above. Whether a person's work is truly good or bad can only be judged by the actual results. Although good motives are important, they must be considered with good results. Working hard and not being upset by criticism is a good spirit, but being busy everyday does not necessarily mean doing more good work. A good manager should not watch over his subordinates every minute to see "how they work," causing the subordinates to be extremely careful and timid. He should inspect their final performance. This is an important behavioral management method. Only this method can truly stimulate people's sense of responsibility, initiative and creativity in work.

We have a lot of practical experience to prove that in the course of management, if we firmly grasp these three guidelines of the behavioral management method and solidify and develop everyone's socialist enthusiasm, then effective management work can be 80 to 90 percent guaranteed.

The value method is the ideological and working method of realizing value engineering. The formula for value engineering is

$$V \text{ (Value)} = \frac{F \text{ (Function)}}{C \text{ (Cost)}}$$

It tells us that to increase the value, one may improve function or reduce cost or both, improve function and reduce cost. Of course the latter is the best method. As an ideological and working method in scientific management, we can call it the "large, high and low goal-oriented management method," i.e., the large value, high efficiency and low cost management method. At present, the so-called "goal oriented management" popular abroad actually embodies a certain aspect of this type of value management method. Using the value principle of socialism to generalize it, the value management method of modern scientific management should have the following three main points: (1) when a manager engaged in management work, he must always keep in mind the fundamental purpose of modern scientific management, i.e., to make one's own management promote the creation of greater economic and social value; (2) in order to realize the fundamental goal above, each manager should continue to implement measures and to think of all ways to "reduce cost" (including the conservation of manpower, energy resources and raw materials, etc.) and "improve efficiency" (including mobilizing the people's enthusiasm and improving work efficiency, etc.); (3) to most concretely achieve the fundamental goals implement the necessary concrete measures with regard to all of the major management objects (people, things, information, time etc.).

## III. The [illegible] [illegible] Required of Managers in Modern Scientific Management

According to the nature, content, main principles and basic methods of modern scientific management, it is not difficult to see that the following accomplishments are required of the manager:

1. He should have broad knowledge and be multitalented. Because modern scientific management is a systematic whole that utilizes the systems principle and systems methods to manage dynamic objects, a management worker must possess the various kinds of fundamental knowledge related to this systematic whole. The knowledge frequently involves natural sciences, economics, other social sciences and social knowledge. Modern management as a science requires the manager to truly become a management specialist. This type of specialist must have a broad knowledge and possess many talents. Otherwise, it will be difficult for him skillfully to carry out complex systems management.

2. He should be resourceful and good at making decisions. Systems management is a kind of dynamic and live management; this type of dynamic and live management requires random feedback and on-the-site decisionmaking involving a massive amount of related information flow, as well as timely action. This requires the modern scientific management worker to be resourceful and decisive, like an "information processor" with a large [illegible] capacity. He should draw on collective wisdom and absorb all useful ideas, he should react sensitively, he should be accustomed to thinking, his decisions should be authoritative and he should be an [illegible] [illegible]. A person who is ignorant and ill-informed, who has few conceptions, who is opinionated or indecisive can hardly become a qualified scientific manager.

3. He should be good at dealing with people. Because the core of the [illegible] [illegible] [illegible] method of management is people, as a management worker, he must be good at dealing with people. First, he should master the "four skills": the skill of knowing people, the skill of [illegible] to people, the skill of being able to use people, and the skill of helping people. He must also realize the "five abilities": the ability to make people listen, to make people trust him, to make people like him, to make people respect him and to make people help him, [illegible] [illegible] win over others. This requires the management worker to be [illegible] [illegible], to know people and to be skilled at employing [illegible] [illegible] [illegible], and to be able [illegible] [illegible] authoritative, if he has a [illegible] [illegible] towards people, if he [illegible] [illegible], [illegible] others, if he abuses his authority [illegible] "[illegible]" [illegible] "[illegible]," then [illegible] [illegible] "[illegible] people" method of management work well.

4. He should [illegible] [illegible] and [illegible]. Because modern management [illegible] [illegible] and the [illegible] method [illegible] the fundamental [illegible] of management [illegible] [illegible]

[illegible] social order, and because [illegible] management actual requires insistence on the principle of responsibility and inspection, management workers must be fair and insist on using the value of results to determine the achievements and faults of subordinates in their work, rewarding those deserving rewards, punishing those deserving punishment, rewarding and punishing clearly, and being impartial and incorruptible. Modern scientific management workers are not allowed to be "indiscriminate officials" who are "not troubled by [illegible]" nor "troubled [illegible]," who "award [illegible] of gold" to those who have done well and who "give [illegible] lashes" to those who have erred. "Indiscriminate officials" cannot do modern management work well.

These requirements and conditions include political ideology, style of work, scientific knowledge and practical experience, and to possess them fully is very difficult. Because of this, modern management work should be emphasized and respected even more. Management workers are honorable. The idea that scientific management work is nothing but administrative work and that scientific management workers are not as important as specialized scientific and technical workers is obviously wrong.

We can use Einstein's equation of mass and energy $E=MC^2$ as the best model for the modern scientific management worker. The formula shows that the energy of matter is directly proportional to the product of the mass M of matter and the fastest possible velocity (the speed of light) $C^2$, i.e., the larger the mass, the higher the velocity, the greater the energy. Now, if we use E to represent the efficiency of management, M to represent the capabilities of the manager, and C to represent the fastest speed of management work, then can we obtain the following optimal model for the modern scientific manager?

Management efficiency E = manager's capabilities M × work speed $C^2$.

In the formula, "capabilities" is a comprehensive concept which includes knowledge, [illegible], quality, work style and required conditions. According to this optimal model, modern scientific management workers are required to [illegible] improve their own capabilities, utilize time and [illegible] work speed in order to realize the greatest management efficiency.

It can be believed that our management workers will [illegible] correctly understand the status and role, the tasks, principles and basic methods of modern scientific management, will continue to improve their capabilities in accordance with their requirements, and will contribute even more to the [illegible] of modern scientific management work.

[illegible] MANAGEMENT [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] capabilities [illegible] [illegible] on strategic [illegible] possible, however. The [illegible] shortages. Moreover, the theory, however, [illegible] [illegible] of a centralized manner.

[illegible] administrative and [illegible] middle level personnel [illegible] these conditions, the [illegible] available [illegible] requirements [illegible]

[illegible] officials, [illegible] who has ability but [illegible] without a job, [illegible] role in the society [illegible] employed according to [illegible] interviews, and [illegible] personnel [illegible]

[illegible] private areas by supplying [illegible] system may be used as [illegible] trained in agricultural [illegible]

[illegible]

WAYS TO [illegible] POTENTIAL OF [illegible]

[illegible]

[illegible] The knowledge [illegible] institutes of higher learning and research [illegible] by academic specialists. [illegible] technical [illegible] They have [illegible] development [illegible] impact on the traditional industrial and agricultural [illegible]

[illegible] problem of matching specialty and profession [illegible] possible. Today, [illegible] college graduates [illegible] the job market's specialty [illegible]

[illegible]

[illegible]

# HELP SCIENTIFIC, TECHNICAL PERSONNEL IMPROVE THEMSELVES

Beijing RENMIN RIBAO in Chinese 30 Sep 82 p 5

[Article by staff reporter Chen Zujia [7115 4371 3946]: "Create Conditions for Scientific and Technical Personnel to Pursue Advanced Professional Studies"]

[Text] In the course of implementing the party's intellectuals policy, the issue of helping the scientific and technical personnel acquire new knowledge and raise their professional level appears to have grown ever more urgent. Visiting Hubei's Xiangfan, Yichang and Shashi, I heard many views on the subject. Engineer Cheng Changrong [4453 2490 2837], assistant chief of the Yichang city second radio plant, told this reporter: What I learned in school in the sixties was electronic tube circuit. I had only 20 class hours of semiconductor, and only had a glimpse of television when taking the specialized course. Now, transistors have become widespread, the integrated circuit is fairly commonly used, large and super integrated circuits are in use, and new things are getting more and more numerous. If I don't study, I shall not be able to keep up. According to a survey of some scientific and technical personnel of the engineer level and above conducted by the Shashi municipal political consultative conference at the beginning of the year, 64 percent of those surveyed said that the "aging of knowledge" was one obstacle to the development of their full effect, and about 89 percent expressed the desire for advanced studies.

The leaders of Xiangfan, Yichang and Shashi understand such feelings of urgency on the part of the scientific and technical personnel. The Shashi municipal party committee's organization department, personnel bureau and committee on science issued a joint announcement, asking the organizations of the various levels to conscientiously create conditions for the scientific and technical personnel to pursue advanced studies, and the municipal association for science and technology specially created the advanced studies department to handle the concrete organizational work. Yichang city included the opportunity and time for the scientific and technical personnel to pursue advanced studies in the resolution of the municipal party committee on scientific and technical work. The measures taken by the three cities can be roughly summarized as follows:

Inviting In and Sending Out. They take all opportunities to invite domestic and foreign scholars and experts to give lectures, hold training classes and organize the scientific and technical personnel to participate in academic activities and technological experience exchange meetings inside and outside the province and to pursue advanced studies in higher institutions. From 1980 to 1982, Shashi city held training classes on foreign languages, mathematical statistics, . design, thermal treatment, thermal balance and boiler water treatment for those either released from work to study or studying while working. The classes were attended by more than 900 people. The Yichang municipal association for science and technology held three sessions of foreign language make-up classes in recent years, attended by 410 persons.

Advanced Science and Technology Colleges. By means of local fiscal support, student aid by the units and subsidy from the funds for science and technology, Xiangfan city started an advanced science and technology college. At present, it has engaged 12 engineers to teach part-time and recruited students for the "scientific and technical cadres' advanced study class," and 5[illegible] people are attending the remedial basic course.

Places of Activities for the Scientific and Technical Personnel. Xiangfan city is in the process of building a science and technology hall, which will be completed next year. It will serve as the center of academic activities and information exchange for the scientific and technical personnel and become a new type of factory producing knowledge.

Scientific and Technical Books, References, [illegible], Measuring Tools and Surveying and Experimental Equipment. Some plants let the scientific and technical personnel decide on the books to be purchased according to their needs and give them priority in reading the new books.

From the conditions of these three cities, we can see that the medium and small cities have certain difficulties in helping the scientific and technical personnel pursue advanced studies. There are mainly two difficulties: Feeling that "distant water cannot quench present thirst," the leaders of some plants fear that advanced studies will affect production and are unwilling to release their personnel. The second difficulty is that, by relying on the strengths of the medium and small cities alone, new information is scarce and the level limited.

Unwilling to release the personnel for advanced studies is actually a shortsighted view. The investment in intelligence has a storing up process. The scientific and technical personnel must first digest and assimilate the new knowledge before applying it and developing the effect in the four modernization construction. Actually, some investments in intelligence can produce results rapidly. After taking [illegible] 1/2 months off to study English, engineer Shi Guoji ([illegible]), assistant chief of

Dongfeng printing and dyeing mill in Shashi city, for instance, independently translated a part of the material on the flat cloth refining and dyeing equipment imported by the plant, while in the past, the plant had to rely on other units to do this work. At one time, the plant had to import a set of evaporating equipment. After learning from other plants that the equipment must be operated with an oil boiler, Shi Guoji, when ordering the equipment, read in its foreign language explanation that it included a superheater which had the same technical functions as the oil boiler. Thereupon, he determinedly decided not to order the oil boiler and saved foreign exchange for the state.

As for the second difficulty, the medium and small cities will not be able to solve it easily. They hope that the scientific research organs of the large cities, the central government and the provincial level and the institutions of higher learning will render a helping hand, such as sending people there to give lectures, accepting short-term appointments to help with their work, making scheduled exchange of scientific and technical information, etc. The forms may be manifold, but the substance must be close to the reality of the medium and small cities. It seems that the request is not excessive and can be easily fulfilled.

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CSO: 4008/[illegible]

# READJUST STRUCTURE OF SCIENTIFIC, TECHNICAL RANKS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 4, 20 Jul 82 pp 3-6

[Article by Huang Wei [7806 5524] and Zhang Jieyu [1728 3381 3842]: "The Structure of China's Scientific and Technical Ranks and Current Measures of Readjustment"]

[Text] How to properly organize China's scientific and technical ranks, develop their collective superiority and adapt to the needs of the national economy in its readjustment and development is a crucial issue urgently calling for conscientious study and solution.

## A Review of the Developmental History of China's Scientific and Technical Ranks

Historically, our party, whether in the revolutionary war years or in the period of socialist construction, consistently gave serious attention to and trained scientific and technical talents and made adjustments in line with the needs of revolution and construction.

As early as at the time of the first domestic revolutionary war, our party, starting from practical needs, trained personnel in communications, public health and military industry in the base areas. Among those sent to study in the Soviet Union in those days, many specialized in science and technology. During the war to resist Japan, large groups of intellectuals converged on Yanan and the various base areas. In preparation for training personnel by the party itself, the Party Central Committee created the Academy of Natural Sciences in June 1940 in Yanan, with such veteran comrades as Li Fuchun [2621 1381 2504] and Xu Teli [1776 3676 4539] serving as its president at different times. During the liberation war, it was moved to the Jin-Cha-Ji [Shanxi-Chahar-Hebei] base and renamed the Regional Industrial School. Subsequently it was merged with the College of Industry of Northern University in the Jin-Ji-Lu-Yu [Shanxi-Hebei-Shandong-Henan] area into the College of Industry (expanded into the Beijing College of Industry after the founding of the nation) of the North

China University, and it trained the first generation of industrial scientists and scientific and technical management cadres for the new China. Today, most of these comrades serve as the responsible persons of the various ministries, commissions, higher schools and plants and mines. Meanwhile, the various liberated areas also ran medical and public health schools and held communications and military industrial training classes to build their own scientific and technical ranks.

After liberation, a group of patriotic scientific and technical personnel studying abroad broke through all barriers and returned to China to take part in construction. Today, many of them have become famous scientists known at home and abroad. In addition, there were also the scientific and technical personnel (approximately 50,000) long engaged in teaching, scientific research and industrial and agricultural construction under the Guomindang regime, and together they formed the scientific and technical ranks in the early days of our republic.

After the founding of the nation, the party vigorously developed science and education and trained personnel for economic construction. To build the Northeast industrial base, the people's government organized a team to recruit large numbers of scientific and technical personnel for the Northeast. Meanwhile, it selected a large group of students to study in the Soviet Union. Today, more than 90 percent of our scientific and technical ranks were trained after liberation. In accordance with practical needs of construction in different periods, the state determined the proportions of different fields of training. During the First 5-Year Plan, for instance, with 156 crucial projects and 694 above-norm construction projects as the core, heavy industry was given priority in development to satisfy the needs of national defense, light industry, agriculture, communication and transportation for equipment and raw material, and the training and readjustments of the scientific and technical ranks were adapted thereto. These measures laid the foundation for our socialist industrialization and prepared the conditions for today's four modernizations. In 1957, the number of scientific and technical personnel rose from the [illegible] percent among the total staff and workers of 1952 to [illegible] percent. Viewed as a whole, the economic construction and the building of the scientific and technical ranks in the First 5-Year Plan period were fairly well coordinated and the development of the roles of the personnel fairly good.

In the first year of the Second 5-Year Plan, the slogan of "doubling" the steel output was proposed. The national economy was centered on steel production, accompanied by higher quotas of other industries and a sharp increase in the number of staff and workers, resulting in their proportional imbalance with the scientific and technical ranks. In 1959, the proportion of engineering and technical personnel in iron and steel dropped from the [illegible] percent among the total number of staff and workers in 1957 to [illegible] percent, and the imbalance in other departments was also more critical.

In January 1961, the Ninth Plenary Session of the Eighth Party Central Committee decided to "readjust, restructure, reorganize and upgrade" the national economy and formed the "Central Scientific and Technical Cadres Planning Group" to make appropriate revisions in the planning of scientific and technical cadres. The focus was on overall planning and arrangements in line with the needs of the four modernizations, and the goal was to build a strong red and expert scientific and technical contingent in number, quality and specialization within [illegible] years. There was an assumption at the time that for every 100 percent increase in total industrial output value, there should be an increase of around 90 percent in the number of scientific and technical cadres and 30 percent in the number of staff and workers. By 1965, a new balance in the proportional relations among agriculture, light industry and heavy industry was achieved, and scientific research and sophisticated national defense industry also made great development. During the "Great Cultural Revolution," with the devastation of scientific and technical work and the abuse and persecution of scientific and technical personnel, and with the suspension of recruitment in colleges and technical secondary schools, the planned and proportional development of the scientific and technical ranks was out of the question.

After the 3d Plenary Session of the 11th Party Central Committee, the shift of the emphasis of party and government work to the socialist modernization construction was defined. Thereafter, the party promptly corrected the leftist mistakes in the economic realm, rectified the proportional relations between accumulation and consumption, between industry and agriculture, and between heavy and light industries, and changed the [illegible] structures within industry and agriculture. Today, with the [illegible] of the national economic readjustment, the situation has again [illegible] for a necessary and appropriate readjustment of the scientific and technical ranks.

This is the starting point in our study of the structure of the scientific and technical ranks.

## [illegible] The Current Structure of the Scientific and Technical Ranks

Whether in distribution, specialization, levels of knowledge or age, [illegible] irrational aspects in the structure of China's scientific and technical ranks today.

1. The distribution of the scientific and technical personnel in the [illegible] of departments of the national economy is irrational. In the past, the assignment of graduates followed the order of military industry first, heavy industry next and light industry last. As a result, only [illegible] graduates [illegible] of technical secondary schools [illegible] were assigned [illegible]. The engineering and technical personnel of the [illegible] percent of the total number of staff and workers. Naturally, as the tasks and the required

technical levels of the different departments [illegible] a uniform proportion. In keeping with their different [illegible] density and labor density, the proportions of their scientific and technical personnel will also differ greatly. However, today the machine and iron and steel departments are relatively overstaffed with scientific and technical personnel, while light industry, energy, communications and agriculture are understaffed. In addition, in the same department, there is the situation of superfluous and complicated setups, "small but complete" and "large yet complete," resulting in [illegible] duplicate scientific research, duplicate production, duplicate import and duplicate construction. In the machine industry, for instance, the military and the civilian, manufacturing and maintenance, universal and special purpose equipment, and central and local government are all under two or more setups. Correspondingly, some scientific and technical personnel perform identical work in different places.

2. In the specialization structure of the same department, the proportion of scientific and technical personnel of the principal and auxiliary specializations is irrational. In most cases, there is a surplus of personnel of the principal specialization and a shortage of those of the auxiliary specializations. In the metallurgical system, for instance, specialists in smelting are excessive, while those in electricity, automation and machinery, the auxiliary [illegible], are inadequate. In [illegible], energy, nuclear physics, radioactive chemistry and [illegible] are overstaffed, while general [illegible] is understaffed. [illegible] there has been through the years a shortage of specialists in [illegible], industrial economics, finance, [illegible], [illegible] and [illegible].

3. The age structure and the proportion of high, intermediate and elementary level personnel are irrational among the scientific and technical personnel. In the Seventh Ministry of Machine Building, for instance, those between ages [illegible] and [illegible] constitute [illegible] percent of the total, and [illegible] as high as [illegible] percent in some research units. Not only a serious aging [illegible] with consequences [illegible], but the concentration of a large number of scientific and technical personnel of approximately the same level in one unit makes it difficult for them to develop their [illegible]. [illegible] a certain research technique, for [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

There are [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the present structure and the [illegible] [illegible] [illegible].

The scientific and technical ranks should be in a state of dynamic balance. Balance is relative, and readjustment and regulation constant. In terms of the scientific and technical personnel, their advancing years will [illegible] produce changes in the age structure. Meanwhile, [illegible] shifts of emphasis in national construction and developments of [illegible] also demand that the structure of the ranks change along with the continuous changes of the objective conditions. To adapt to the dynamic [illegible] of "from relative stability to change, and from change to relative stability," readjustments are necessary, so that different kinds of talents are at their proper posts and in the proper relations. It is the very task which we must [illegible].

## Methods to Readjust the Structure of the Scientific and Technical Ranks

On the basis of our investigation in Lanzhou, Wuxi, Xining, Nanjing, Xiangtan, Shashi and Tianjin and in conjunction with the readjustment of the national economy, there are mainly the following four methods to readjust the surpluses and shortages of the scientific and technical strength:

1. Personnel transfer (changing the subordination relations). (1) Transferring personnel from large cities to medium and small ones: More than 1,000 persons have been transferred to Lanzhou and more than 600 to Xiangtan and Shashi each. Most of the transferees have become the technical backbone of the enterprises of the locale and promoted the development of these places. (2) On-site regulation, balancing the shortages and surpluses and rendering support to light and textile industries in [illegible] need of personnel: Lanzhou and Wuxi have readjusted more than 1,000 scientific and technical personnel, transferring the greater part of them to light industry and textile and quite a number to collective enterprises. Xiangtan and Nanjing have also transferred personnel from [illegible] and machine industries to light, textile and electronics industries. [illegible] new industrial plants in Tianjin were handed over to the [illegible] Municipal Light Industry Bureau to manufacture wristwatches, [illegible], sewing machines, etc. Naturally, the transfer must not cause [illegible]. (3) Internal regulation within the system: When the [illegible] was first formed in [illegible], for instance, [illegible] the enterprises among the [illegible] scientific and technical personnel. In the past 2 years, [illegible] personnel were transferred to them, including [illegible] from [illegible] enterprises, thereby promoting the development of production [illegible] in some instances. (4) [illegible] with leadership, organization and planning: Advertising [illegible] Xining [illegible] selected [illegible] persons out of [illegible], and [illegible] persons have been promoted to assistant [illegible] of [illegible].

[illegible] (1) [illegible] joint operation [illegible] companies, [illegible] complement [illegible] scientific and technical personnel [illegible] extended range. (2) Organizing inter-trade and trans-departmental technical [illegible]. There are [illegible] colleges and universities [illegible] and research institutes [illegible]. [illegible] For instance, [illegible] with [illegible] research institutions in Beijing, Shanghai, Tianjin, Nanjing and [illegible] to cooperate on [illegible] scientific research projects. (3) Organizing technical consulting services. The [illegible] research [illegible] scientific and technical consulting [illegible], for instance, are [illegible] training [illegible] the plants [illegible] difficulties. [illegible] scientific and technical [illegible], in some form of [illegible] technical strength.

3) [illegible] Training and Evaluation. Without [illegible] the State [illegible] scientific and technical advanced training [illegible]. For instance, the [illegible] in the past 2 years [illegible] cadres and skilled workers [illegible]. The [illegible] by the [illegible] textile [illegible] class and two technical secondary classes. The [illegible] cadres [illegible] level, receive [illegible] training in professional knowledge. [illegible] industry in [illegible] technical secondary schools. The measure also solved the problem of the [illegible] which had experienced difficulty in getting personnel, because [illegible] trained the kind of specialists needed by it.

4) [illegible] Investment [illegible]. The [illegible] Second [illegible] 1985 [illegible] secondary [illegible] 1985 and [illegible] assigned [illegible]

[illegible]

[illegible] works.

[illegible]

the [illegible] small ones. [illegible] page is [illegible].

The reasons for [illegible] depart-mentalism. [illegible] people make it easier to [illegible] the work," [illegible] the more people under their control, the greater is their [illegible]," and that "the more [illegible] and used [illegible] in the [illegible] of the scientific and technical ranks. This mentality is closely linked with the old management system of "unit ownership" and "eating [illegible] big pot." [illegible] units fear that [illegible] units will [illegible] their "[illegible]" or, failing to [illegible] the [illegible] strengths and [illegible] their own products [illegible], they do not feel the need to improve the competitive capability of their products; therefore, they are not enthusiastic [illegible] the scientific and technical personnel [illegible] living [illegible].

[illegible]. The [illegible] view held by some that [illegible] cooperation, and [illegible] "underground [illegible]," [illegible]. [illegible] the understanding [illegible].

[illegible] scientific and [illegible] the [illegible] department [illegible] personnel in the [illegible] readjustment [illegible] and [illegible].

[illegible] scientific and [illegible].

[illegible] scientific [illegible].

scientific and technical data [illegible] and the [illegible] and [illegible] items of [illegible] [illegible] of the [illegible]. analyzed the [illegible], [illegible], functional and administrative structures of the [illegible] and the surpluses and shortages of particular kinds of specialists, analyzed the reasons and the [illegible], made specific suggestions to the municipal Party committee and municipal government and [illegible] between the [illegible] and [illegible] units. [illegible] city has a [illegible] in the [illegible] of [illegible]. A work team led by the municipal [illegible] committee [illegible] and vice mayors and composed of scientific [illegible] and heads of personnel, labor, public security and industry units [illegible] in such areas as Xian and Tianjin, verified on site, and "recruited" [illegible] persons, thereby strengthening the light and textile industries of the city.

[illegible] The [illegible] of the [illegible] system must be introduced, and the management of the scientific and technical ranks strengthened. The [illegible] of [illegible], the [illegible] levels for the posts and the number of personnel needed by the industries must be clarified and the surpluses and shortages ascertained before filling in the gaps.

[illegible] recruitment must be carried out with [illegible] given [illegible] with [illegible] [illegible] unit [illegible] and the superior selected for employment. The [illegible] the scientific and technical ranks and [illegible] them [illegible].

In recent years we have gained some experience and made some encouraging achievements in the matter of [illegible] the structure of the scientific and technical ranks. In the future, with the implementation of the principle of [illegible] development of science and technology and economic construction [illegible], the readjustment of the scientific and technical ranks will become more rational, enabling China's scientific and technical [illegible] to play a more vital and positive role in the realization of the great [illegible] transformation.

## ROLE OF UNIVERSITIES IN INTEGRATION OF SCIENCE, TECHNOLOGY STRESSED

Shanghai WEN HUI BAO in Chinese 4 Jun 82 p 3

[Article by Xie Xide (6200 1585 1795): "Utilize the Advantages of the University Science Departments to Accelerate the Development of Technical Sciences"]

[Text] [Abstract] The author believes that as a consequence of the current development of science and technology there is a trend toward extensive multidisciplinary integration and interpenetration of such subjects as science, engineering, agriculture and medicine. As a result, some of our country's universities with a relatively complete range of academic subjects should make full use of the advantages of the science departments, integrate science with engineering, and [illegible] new sciences; this will greatly accelerate the development of science and technology in China. The author suggests that the existing science departments be used as a base for strengthening vertical and horizontal ties between various fields of study, developing [illegible] engineering and technical subjects, and training more engineering and technical personnel with a good foundation and a wide scope of knowledge who can lead the way in the borderline sciences and who [illegible] theory and practice.

The integration of science and engineering has been assigned considerable importance in recent years; the reason is that the development of science and technology and the needs of the four modernizations have made it a necessity. But recently, worldwide experience in scientific and technical development has demonstrated that simple adherence to the slogan of integration of science and engineering is already well behind the demands of practice. The experience of worldwide scientific and technical development tells us that extensive integration and interpenetration of science, engineering, agriculture and medicine has already manifested itself [illegible] in [illegible], and that many accomplished and ambitious scientists have made great achievements in the development of borderline sciences, [illegible] developmental trends that are universally known as [illegible].

In this brief article I would like to discuss the ways of utilizing the advantages of university science departments in the process of accelerating scientific and technical development in this country. The close integration and mutually supporting relationship of the natural sciences and engineering is an important characteristic of present-day scientific and technical development. The development of technology grows daily more dependent on basic science, which enables technology to increasingly take on the characteristics of experimental science, while conversely, scientific research becomes increasingly dependent on breakthroughs in various types of engineering and technology and on technical equipment, with the result that scientific research increasingly takes on the characteristics of engineering and technology. The field of technical science has taken shape between science and engineering. For example, applied mechanics is connected with basic science (physics, theoretical mechanics) but also directly serves aeronautical engineering and other engineering subjects, so that it is one of the technical sciences. Some foreign scientists believe that technical science should be treated as a basic science. In terms of the specific situation of our country's socialist construction, the four modernizations require not only that we train personnel in the humanities, social sciences, natural sciences, management sciences and engineering, but also urgently require that we train research and development engineers and technicians with a relatively broad and solid basic theoretical knowledge. The question of how the specialized curriculum of advanced schools can adapt to the need of scientific and technical development and the training of qualified personnel has become an extremely prominent one.

After Liberation, the specialized curricula in our advanced schools were basically patterned after the Soviet model, and their main deficiency is that science, engineering, agriculture and medicine are separate, so that they are unable to adapt to the needs of scientific and technical development and national construction. In the last few years, many engineering academies and schools have established scientific specialities with the aim of solving the problem of integrating science and engineering. Our experience indicates that if the scientific colleges establish some technical-science specialties rather closely associated with the original basic sciences and make full use of the advantages of this type of university, namely that the basis in theoretical natural science is rather solid and there is a [illegible] complete range of departments, this will [illegible] of science and technology and the integration of science, engineering, agriculture and medicine, and the [illegible], and will also make it possible to train the qualified personnel needed by the four modernizations more effectively and to solve more quickly the major problem of making our science and technology independent. Naturally these newly established technical science specialties will have different requirements, depending on their individual bases and conditions. Some of them can accept undergraduate and graduate students, [illegible] scientific research and accept graduate students, or start with [illegible] accept [illegible].

The mechanics major was established in [illegible] in the department of mathematics, and it has a rather extensive mathematical basis; 16 classes of about 600 students have been graduated and are now distirbuted among the research departments, advanced academies and schools, plants and the like. Because they have rather solid basic knowledge they can play a rather good role in their work and are highly thought of in their organizations. The dissertation of a graduate student who graduated in 1981 was evaluated by the director of the University of Texas Aerospace Center as being at that school's PhD level. The mechanics major developed into a field which has both theoretical and applied aspects and includes nearly 10 areas, such as failure mechanics, structural mechanics, vibration mechanics, turbulence mechanics, computational solid-body mechanics, computational fluid mechanics, and biological fluid mechanics. In the past few years it has accepted and completed more than 30 theoretical and applied research tasks involving such fields as aviation, space flight, marine navigation, structures, transient states, and machinery; some examples are hydraulic cla coal mining, three-dimensional flow in turbine wheels, and the theory of liquid lubrication. Some of the projects, such as the application of nonlinear failure mechanics and solid body mechanics in aeronautics, three-dimensional fluid dynamics, theory of transient states, and nonlinear vibrations have won major Shanghai municipal awards for science research achievements, and some have also won Class 2 awards from the First Ministry of Machine Building and achievement awards from the Seventh Ministry of Machine Building.

Our chemistry department has also made considerable achievements in utilizing the advantages of science departments and developing technical sciences. In the field of high-molecular-weight substances, the rather brittle material polystyrene had rather limited uses, but as a result of rather extensive structural study of high-molecular-weight materials in the styrene series, and the use of all of the school's research facilities, the chemistry department was able to copolymerize fibrous acrylonitrile and resinous butadiene and other substances in polystyrene, thereby changing its properties; it ultimately developed ABS for the electrical industry, HIPS (high-impact polystyrene) for television set housings, SBS elastomers, the rather smooth and transparent MBS, and other modified polystyrene materials, which greatly expanded the selection of polymer materials and increased the range of application of styrene materials. Materials containing the trace elements are rather abundant in our country, and in recent years the chemistry department has used its research on their optical, electrical and magnetic properties to cooperate with the Institute of Electrooptics in applying rare earth materials to electro-optical light sources; it has developed high-efficiency, low-power-consumption fluorescent lights in the three basic colors, and energy-saving photolithographic light sources, which are already in use in many printing and publishing houses throughout the country, with an capacity of saving an estimated several thousand kilowatt-hours of electricity a year.

Thus, it is apparent that using a scientific basis to develop certain engineering and technical fields (different from ordinary engineering in that they involve training engineering and technical personnel with rather solid knowledge of basic theory and a rather broad range of knowledge, who are better able to lead the way in the borderline sciences, and who combine theoretical and practical skills) offers even greater advantages and is more beneficial to developing borderline sciences. At present, our school is proceeding from its existing base to study the questions of how to make further use of the advantages of the scientific departments and is establishing horizontal and vertical ties between the various disciplines; for example, research on hydrid optical-signal computer systems, the use of nuclear technology in surfaces and semiconductor components, the use of laser technology in surface science, chemistry and physics in materials science, the integration of biology, mathematics and physics in biomechanics, and the integration of physics, chemistry and biology in breeding, genetic engineering and environmental science, in order to accelerate the development of science and technology.

[illegible]
CSO: [illegible]/199

# INBREEDING IN SCIENTIFIC TRAINING MUST BE ELIMINATED

Beijing RENMIN RIBAO in Chinese 19 Sep 82 p 3

[Article by staff correspondent Liu Jun [0491 6511]: "Overcoming the Phenomenon of 'Inbreeding' in the Training of Qualified Personnel"]

[Text] Xie Xide [6200 1585 1795], delegate to the 12th CPC National Congress, vice president of Fudan University, and a noted physicist, recently held a talk with reporters on developing educational and scientific work. In this talk she pointed out that overcoming the phenomenon of "inbreeding" has become a major and pressing problem in the training of qualified personnel in China's institutions of higher learning and scientific research centers.

Professor Xie Xide first analyzed the current state of work assignments for college students and graduate students. She said that due to the influence of outmoded practices, units were frequently reluctant to part with their best personnel. Among the personnel in certain centers, there were great concentrations of pupils redundantly taught by the specialists and professors of these faculties. They carried out their work in teaching and scientific research under semi-secluded conditions. Some people even regarded the graduate students of these units as "offspring." Sectarianism is still quite a serious problem.

Professor Xie Xide believes that, in the historical situation in which science has not yet been fully developed, the method of "inbreeding" has created a school of thought that plays a definite role in carrying forward traditional practices. However, with the swift development of modern science and technology, this personnel structure no longer fits the new circumstances of today. In the 20th century the development of science and technology has caused various disciplines to intersect and permeate each other. This has given rise to a great number of new and developing borderline disciplines. Major achievements in scientific research depend primarily on people engaged in different types of specialized research who cooperate with each other and on the open discussions among different schools of thought dealing with the same area. Only by learning from others' strong points to offset their weaknesses can they achieve success. Last spring when she visited the United States and lectured at Washington University, Princeton Universith and Smith College, she saw and heard many famous specialists and professors who let their own students move on. Even among the superior students, very few stayed to carry on the work.

Professor Xie Xide said that, in comparison, China's current personnel structure is clannish, closed off, and quite backwards. This is because, even though the level of specialists and professors is high and acquired knowledge is handed down in the proper way, individual knowledge is after all limited. Working for any length of time within such a closed-off system will lead to people being ignorant, ill-informed, closed-minded, and congealed of thought. Furthermore, this organizational form may engender the work style of considering qualifications and arranging rank according to seniority as well as paternalism. It may also lead to exclusivism and departmentalism. This would not be advantageous to developing a scientific democracy and opening up cooperative interchange. It hinders attaining significant achievements and training outstanding qualified personnel.

Professor Xie Xide pointed out that in correcting this "inbreeding," the important thing is to implement the exchange of qualified personnel. For example, we must select core teachers to go abroad to engage in advanced courses. We must also invite outstanding teachers from abroad and from other schools to give lectures. We must cooperate to launch work in scientific research, etc. In Shanghai, a cooperative group on teaching resources from Fudan University, Tongji University, Normal University, Jiaotong University, and Shanghai First Medical College which was established a year and a half ago adopted a series of effective measures to gradually overcome the phenomenon of "inbreeding." First, every March before reporting assignment plans, the group recommended to each other outstanding graduate students and college graduates to replenish the ranks of qualified teachers. Next, every year, from among either the young teachers remaining at the school or the middle-aged core teachers, they selected a fixed number of people to send to key departments in fraternal colleges and universities to give advanced instruction to teachers or to do short term work. Among them, some teachers could directly participate in the work of the teaching and research groups of the fraternal schools. Third, from the originally-constituted ranks of teachers, some were reassigned to fraternal schools [fulltime] to work in instruction and scientific research. Experience has shown that doing this will encourage the exchange and sharing of different academic viewpoints among various departments. At the same time teaching matter and instruction methods will be varied due to having teachers with different academic views. This will expand the horizons of students, broaden their thinking and further develop their creative spirit.

In order to basically break through the clannish and closed off state that exists at the present time, she suggested that when the time is ripe we should abolish the full-time teaching assistant system and assign all college graduates to work in plants, in the countryside, and in scientific research units. Teaching assistants should be appointed to part-time positions from the ranks of graduate students, and lecturers should be selected and appointed to positions from among the cream of the crop in plants and scientific research units. Graduates should not remain in school to make careers of teaching. Only after going through exchanges to broaden their field of vision will they be able to make a contribution.

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[illegible]

## DIRECTIONAL FLOW PROBLEM OF SCIENTIFIC, TECHNICAL PERSONNEL DISCUSSED

Beijing GUANGMING RIBAO in Chinese 12 Jul 82 pp 1, 4

[Article by Tao Kai [7118 6963] and Ceng Qing [2582 3237]: "On the Question of Directional Flow of Scientific and Technical Personnel"]

[Text] Abstract

The directional flow of scientific and technical personnel is an urgent problem in today's personnel issue that awaits a solution. Science and technology transfer and most importantly the transfer of scientific and technological capability are generally accompanied by the flow of personnel. To accommodate the needs of the national economic readjustment, personnel should flow from heavy industry to light industry, from publically owned enterprise to collectively owned enterprise, from large cities to medium and small cities, from coastal area to inland and from the urban area to the rural area. The approach taken recently by some medium and small cities of developing science and technology potential by the directional flow of personnel and knowledge has had prominent effects. Personnel recruiting activities conducted by personnel and cadre departments are one form of personnel flow activity. It is a supplement to the current personnel cadre system.

The scope of scientific and technical personnel problem is very wide, it includes such issues as personnel cultivation, utilization and management. These issues in turn are intimately related to the policy on intellectuals, the economic system, the personnel cadre system, science and technology policy, educational system and the party's political and ideological work. We believe that, to solve the personnel problem, the urgent problem today is the directional flow of scientific and technological personnel. This problem arose from the following facts: on the one hand the national economic readjustment and development required vast manpower and the phenomenon of supply not meeting the demand was very serious; on the other hand, the stagnation and waste of personnel is quite prevalent but the potential in personnel is very strong. This contradiction came about because, under the long term influence of the "leftist" thought and the bondage of irrational management system, there was no sensible personnel flow in many departments, prefectures and units.

[illegible] has been detrimental to the development of the economy and science and technology and to the growth of personnel. Therefore, in order to revitalize the economy and thoroughly carry out the [illegible] coordinated development of the science, economy, and society "trinity," we must further purge the [illegible] flow, have an overall and [illegible] understanding of the personnel [illegible], put the [illegible] regarding [illegible] on an even solid basis, [illegible] personnel [illegible] management [illegible] and [illegible] and [illegible] flow of specialists under the guidance of a universal [illegible] the conflict between personnel shortage and economic and S and T development may be resolved.

## (3) [illegible] Personnel Flow from the Viewpoint of Science and Technology Transfer

Science and technology transfer refers to the trade, transplant, import, [illegible] and [illegible] of scientific and technological results, information and [illegible]. The most important aspect is the transfer of scientific and technological capability. Generally speaking the transfer of S and T capability is always accompanied by personnel flow and the relationship between the two is very close.

Science and technological transfer may take place via a number of channels, [illegible]. The transfer may be from laboratories to production and application, [illegible] to civilian use, from advanced regions, departments and industries to backward regions, departments and industries, from cities to [illegible] and from overseas to domestic. In order to save space and to [illegible] the [illegible] between science and technology transfer and the [illegible] personnel [illegible], we will focus our discussion on the [illegible] from advanced regions, departments and industries to backward region, [illegible] and [illegible] and from cities to rural areas.

[illegible] have been [illegible] China's national [illegible] reasons, [illegible] between [illegible] and industries, [illegible] between coastal and inland areas. Take [illegible] only one [illegible] less than one [illegible]. The per capita value [illegible] in Shanghai and that in [illegible]. The unbalanced [illegible] raised [illegible] and [illegible] and the [illegible] industries and regions [illegible] irrational [illegible] in the distribution of S and T personnel. For [illegible] personnel are [illegible] and all [illegible] is used [illegible] products.) The [illegible] distribution [illegible] flow as [illegible]

The [illegible] and [illegible] national economic development, to [illegible] rationalization of economic structure, to [illegible] technological improvements and in the intellectual renewal of the staff and workers rank, that is to say, the readjustment of the S and T rank and the directional flow of personnel are essential. In order to correct the lack of correlation in the development of capital goods and consumer goods, the irrational distribution of personnel must be [illegible]. It is unimaginable trying to accomplish the tasks of national economic readjustment and technological improvement without S and T [illegible] transfer.

China's agriculture production is still at a rather undeveloped state. From 1949 to 1979, heavy industry has grown more than 90 [illegible], light industry has grown about 20 fold, but agriculture has only undergone a few fold increase. This situation has greatly affected the nation's economic development and the improvement of the standard of living of the people. In developing a modernized agriculture production we must take an approach that fully exploits the advantages of traditional Chinese agriculture, that [illegible] in the meantime broadly borrows from the results of modern science and technology and the approach must require modest capital investment, consume less energy, and is high in efficiency and favorable to the protection of the ecological environment. The transfer of S and T from cities to countries should include the transfer of S and T capability and S and T personnel. This should not be overlooked.

The imbalanced development of S and T development in the coastal regions, in the inland regions, in large and medium cities, and in rural areas is historical. An important issue in the socialist construction is to gradually reduce this discrepancy. This would be beneficial to the political stability, security [illegible] and the solidarity and friendship among the various races. To a large extent, the reduction of this discrepancy will rely on the S and T transfer to these areas, including the directional flow of personnel.

[illegible] of personnel flow always [illegible] they seem to [illegible] directional flow as [illegible] and [illegible] the socialist economic plan and [illegible] liberal [illegible]. [illegible] they interpret personnel flow as [illegible] and disregarding the [illegible] of the state. [illegible]

Directional Flow [illegible]

[illegible]

[illegible] cities, [illegible] in the [illegible] rural areas.

[illegible] should [illegible] organized [illegible] and [illegible] opposite [illegible] in some [illegible] areas flowing [illegible] inland, [illegible] specific [illegible] are required. However, as long as we [illegible] policy on [illegible] special [illegible] large numbers [illegible] personnel [illegible] with [illegible] the [illegible], the [illegible] problem can [illegible]

[illegible] socialism, [illegible] development plan of [illegible] in realizing [illegible] the current situation [illegible] we believe it is [illegible] many units [illegible] personnel. [illegible] organizat[illegible] of S [illegible] personnel [illegible] in their specialt[illegible] Thirdly, the [illegible] S and T personnel [illegible] rational: [illegible] industries and [illegible] particularly [illegible] level [illegible] S and T personnel [illegible] a large [illegible] technical personnel [illegible] that [illegible]

[illegible] existing [illegible] strength [illegible] that it [illegible] years some [illegible] personnel [illegible] this [illegible] and [illegible]

[illegible]

[illegible] cannot [illegible] share [illegible] and let [illegible] they [illegible] about their [illegible]

[illegible]

[illegible]

[illegible]

[illegible] research [illegible]. [illegible] in order to [illegible] daily operations.

[illegible] in the early [illegible] conventional. For [illegible], the [illegible] has organized [illegible] and [illegible] history and development of the northwest industry. [illegible], is not resulting in [illegible] being planned [illegible] local governments and [illegible] expertise in [illegible] for information transmission purposes, all [illegible] personnel procedure [illegible] is [illegible] for personnel. [illegible], it [illegible].

[illegible] problem we [illegible] in [illegible] and planned fashion. [illegible] development of S and T and [illegible].

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] at all levels of the [illegible] FDA [illegible] research [illegible]

[illegible]

[illegible]

[illegible]

[illegible] had [illegible], the [illegible] and a professionally oriented [illegible] to improve [illegible] along with [illegible] interrelat- [illegible], and [illegible], the [illegible] of scientific [illegible] work.

[illegible] of the last [illegible] years, [illegible] scientific [illegible] were [illegible] completed [illegible] the majority were conducted by middle-aged scientific [illegible].

[illegible] middle-aged [illegible] quarters, primarily, [illegible] a great majority of [illegible]

## SCIENTIFIC, TECHNICAL WORKERS URGED TO STRIVE HARD

Beijing RENMIN RIBAO in Chinese 26 Sep 82 p 1

[Article: "Second Plenary Session of Second National Committee of China Association for Science and Technology Issues Proposal Calling on Scientific and Technical Workers to Strive for the Great Goal"]

[Text] Beijing, 25 Sep (XINHUA)--The Second Plenary Session of the Second National Committee of the China Association for Science and Technology today issued a proposal to the scientific and technical workers throughout the nation, calling on them to conscientiously study the documents of the 12th National Party Congress, thoroughly understand its spirit and unify their thinking on its programs and its principles and policies.

The proposal also appealed to the scientific and technical workers throughout the nation to enhance their revolutionary vigor, work hard and make outstanding achievements, while actively developing the collective wisdom and initiative, strengthening the link between the work in natural science and that in social science and promoting together the integration of science and technology with economics and society; to actively participate in the solution of major scientific and technological problems in the technical reform of industries, in the improvement of enterprise management and in the construction of key projects and offer advice and make suggestions for the readjustment and restructuring of the national economy, for the enhancement of labor productivity and economic results [illegible] attention [illegible] and fulfill their proper [illegible] in raising the scientific and technical level of the entire nation; to actively train [illegible] scientific and technical personnel; to reinforce their own ideological construction, consciously uphold the four basic principles and [illegible] their [illegible] spirit [illegible]. The proposal expressed the hope that the scientific [illegible] Taiwan province and those residing [illegible] will, together with those on the mainland, devote their efforts to [illegible].

The plenary session was held in Beijing from [illegible] September to today. The attending members conscientiously studied the documents of the 12th National Party Congress and discussed how the association should implement the spirit of the party congress in its work in order to adapt to the demands of the new situation. Fang Yi [2455 [illegible]], member of the CPC Central Politburo, made a statement at the meeting. Pei Lisheng [5952 7787 3932], vice chairman of the association, gave a work report entitled "Unite and Mobilize the Broad Scientific and Technical Workers and Contribute Our Efforts to the Unfolding of a New Phase in the Socialist Modernization." The scientists and engineering and technical experts at the meeting remarked joyfully that achieving the goal of tripling the total annual output value of industry and agriculture within 20 years hinges on the progress of science and technology and that the time for China's scientific and technical workers to make great plans has arrived. They demonstrated from many aspects the practicality and feasibility of the economic developmental goal proposed by the 12th National Party Congress and enthusiastically made suggestions for its realization. In their statements at the meeting, Qian Xuesen [6929 1331 2773] and Hua Luogeng [illegible], a total of more than [illegible]0 famous scientists and engineering and technical experts, expressed their views and made suggestions on how to solve the problems in agriculture, energy, communication, education and science and how to build a socialist spiritual civilization.

Pursuant to the demands of the 12th National Party Congress, the plenary session discussed and decided on the tasks of the association in the future and pointed out that the association must truly become the link and bridge between the party and the intellectuals and that it must mobilize and organize the broad scientific and technical workers to make contributions for creating a new phase in the socialist modernization.

The plenary session announced that the [illegible] secretariat of the association will consist of Wang Shun[illegible] [illegible]17], Liu Dongsheng [illegible], [illegible] [3944 [illegible]33], [illegible] [illegible]80 0109 0022], Huang [illegible], [illegible] [11[illegible]], [illegible] [3048 0366 4135], [illegible] and Wa[illegible] [illegible], a total [illegible] Bamin [2651 [illegible] [illegible]

[illegible]

[illegible] Scientific Information [illegible]

[illegible] scientific information [illegible]

[illegible] revolution." This revolution has had a profound [illegible] produced major changes in the [illegible] research [illegible] and there has been an abrupt increase [illegible] the western scientific community refers [illegible] "information [illegible]" [illegible]

[illegible] been created. It is necessary [illegible]

[illegible]

[illegible] information science itself. For example, it [illegible] information, [illegible] behavioral [illegible] interrelated development [illegible] information [illegible]

[illegible] by this example: the average value of output per person in Shanghai [illegible] dollars, [illegible] than that [illegible] in Beijing. The capital utilization rate in Shanghai was twice that of Beijing or Tianjin, four times that in Guangzhou and six times that of [illegible]. [illegible] inland cities, it is even higher. Changzhou, [illegible] high speed industrial development [illegible] by learning from Shanghai and other developed regions. [illegible] industrial value [illegible] economic and technological cooperation with Shanghai. They [illegible] their progress to a large part through the new technology, new [illegible] and new information provided by S & T information. So you see how useful [illegible] S & T information can be!

[illegible] In the last few years [illegible] billion dollars of new technology and introduced [illegible] scientific and technical journals and magazines and a substantial amount of patents [illegible] information. [illegible] Zhao Ziyang asked us to [illegible] early 1980 level technology in China's existing [illegible] utilization of [illegible] now? There is a long way [illegible]

[illegible] the actual [illegible] of China's S & T information. [illegible] development plan was being [illegible] participation of [illegible]. After the [illegible] Premier Zhou asked them, "How [illegible] an information organization?" The con[illegible] of Premier Zhou and [illegible] in the national [illegible]. This was the beginning of [illegible]

[illegible] formulated [illegible] Chairman Mao [illegible] the question of [illegible] Chairman Mao [illegible] Chairman [illegible] foreign [illegible]

[illegible]

According to Comrade Wu Heng, many cadres in the economic departments have not yet made good use of S & T information. Some simply do not understand the importance of information. A good number of scientific and technological personnel do not know how or are not used to looking up domestic and foreign information and data. Insufficient usage of currently available technological information has led to redundant scientific and technological research, prevented some enterprises from cornering a greater market and is the cause for falling into traps in importing foreign technology and equipment.

Comrade Wu Heng told us that he had heard from comrades of the Sichuan provincial scientific committee that when Comrade Zhao Ziyang was working in Sichuan, on many occasions he made comments about information and data published by the Sichuan S & T Information Office. In April, 1982, Premier Zhao had again given important instructions to the science committee regarding the management of computer data search.

During this annual meeting, Comrade Wu Heng made three requests to the information workers: provide information for solving S & T problems, provide information for establishing national economic and S & T plans, and actively develop consulting services. He hoped that all the information workers and comrades in the information-using departments will cooperate closely to make sufficient use of currently available information in China to make contributions to quadrupling the gross annual value of output.

[illegible]

[illegible]

## CURRENT TASK OF SCIENTIOLOGY IN CHINA [illegible]

Hong Kong WEN WEI PO in Chinese 2 Nov 82 p 14

[Article by Li Chang [illegible] 2490]: "Our Current Task of Studying Scientiology"]

[Text] The new and developing science of scientiology has taken a speedy development abroad, but in recent years has also received close attention in various quarters of China, since science and technology have shown themselves of tremendous force in creating wealth. This fact spurred people on to make science the object of their study and to provide a theoretical basis and methodology for the management and policy decisions of scientific research, for the purpose of ensuring a smooth development of the scientific and technological undertakings. Since 1979 our country has convened two national symposia for scientific discussion of scientiology and is presently convening another symposium, for the particular discussion of the theory of scientiology and for an exposition of the aims of the study of scientiology and the special features and trends in the contemporary development of science and technology. I was greatly enlightened and inspired by the speeches given by the various participants at the symposium and by their articles. Allow me to state my personal views on various questions concerning scientiology.

[illegible] the study of scientiology in our country must primarily solve the following questions within a certain period of time:

### 1. [illegible] Integrating Theory and Practice, [illegible] the Important Role of Science and Technology in the Social Development

At the 1978 National Science Congress, Comrade Deng Xiaoping affirmed the conclusion of science and technology being productive forces, a fact that for a long time already has been no more a question in the capitalist countries because of [illegible] fast development and application of science. Modern science [illegible] as an accompanying phenomenon of capitalism, a development that was centered in the cities. The Western bourgeoisie first [illegible] against feudalism and later again as a means of [illegible] wealth and of conquering [illegible] world. [illegible] Western [illegible] the great [illegible] value of [illegible] nations [illegible] different. Our country's [illegible] in the past [illegible] brilliant culture and advanced

[illegible]

[illegible] determine its developmental [illegible] the field of [illegible]

[illegible] social deve- [illegible]

[illegible]